Washington State Department of Transportation

MEMORANDUM

12/29/2005

TO: Ed Barry/Zak Griffith
NW Region Project Office, NB82-75

FROM: Tony Allen/Andrew Fiske
E&EP Geotechnical Division, MS 47365

SUBJECT: SR-405, XL-2406
Canyon Park Freeway Station
Geotechnical Report

Attached to this memorandum is the final draft of the geotechnical report for the Canyon Park Freeway Station project in Bothell. This report contains recommendations for bridge foundations, including driven pile and spread footing options, and retaining wall recommendations, including type selection, lateral earth pressures, allowable bearing pressures and settlement considerations. Recommendations are also provided regarding site seismicity, construction considerations for foundations and walls, and foundation recommendations for signs and signals.

If you have questions or require further information, please contact Tony Allen at 360.709.5450 or Andrew Fiske at 360.709.5456.

TMA: ajf

cc: Chris Johnson, NWR Materials Laboratory, NB82-29
Mark Anderson/Brian Aldrich, Bridge & Structures, 47340

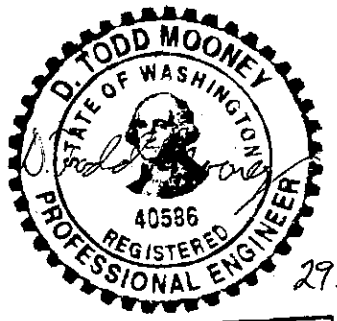
GEOTECHNICAL REPORT

Canyon Park Freeway Station

SR-405, XL-2406, Milepost 26.65

Prepared by:
Andrew J. Fiske
Geotechnical Engineer

Reviewed by:
D. Todd Mooney, P.E.
Senior Geotechnical Engineer

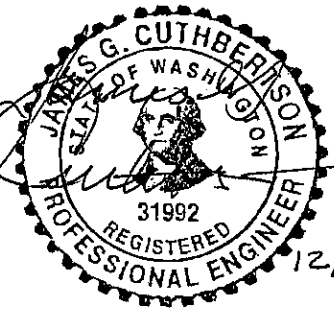


29 Dec. 05

EXPIRES 09-23-06

Reviewed by:
James G. Cuthbertson, P.E.
Chief Foundations Engineer

Reviewed By:
Tony M. Allen, P.E.
State Geotechnical Engineer,
Agency Approving Authority



12/29/05

EXPIRES 03-13-06

December 29, 2005

Table of Contents

1. INTRODUCTION

1.1. GENERAL

This report presents results of a geotechnical study performed for the SR-405 Canyon Park Freeway Station project in Bothell. The location of the project site is shown on the Site Map, Figure 1 in Appendix A. The purpose of the project is to minimize transit delays at the SR-527/SR-405 Interchange by adding a transit stop on the southbound on-ramp to SR-405. A new pedestrian bridge will connect the transit stop to the existing Park & Ride lot on the east side of SR-405.

This report contains recommendations for bridge foundations, including driven pile and spread footing options, and retaining wall recommendations, including type selection, lateral earth pressures, allowable bearing pressures and settlement considerations. Recommendations are also provided herein regarding site seismicity, construction considerations for foundations and walls, and foundation recommendations for signs and signals.

The analyses, conclusions, and recommendations provided in this report are based on our understanding of the project and site conditions existing at the time of our site review and field exploration program. The exploratory borings are assumed to be representative of the subsurface conditions at locations throughout the site. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

1.2. PROJECT DESCRIPTION

The centerpiece of Sound Transit's Canyon Park Freeway station is the new pedestrian bridge that will connect the Park & Ride lot on the east side of SR-405 to the new transit stop on the west side of SR-405. The new pedestrian bridge will be comprised of pre-cast tub girders supported on seven piers. The bridge will have span lengths between 70 and 125 feet. An elevator shaft is planned at Pier 1, which is located on the edge of the Park & Ride lot. A small approach fill is planned at Pier 7.

Design and construction of a new transit stop will also include minor revisions to the southbound on-ramp. These revisions include ramp widening, which will require several short (in height) retaining walls. New signalization is also planned for the on-ramp. On the east side of the interchange, modifications to the existing pond and site drainage are planned.

2. PROJECT SUBSURFACE CONDITIONS

Subsurface conditions at the project site were explored by WSDOT drill crews, a summary of the field explorations and boring logs are included in Appendix B. All exploration logs should be made available to prospective bidders and included in the contract documents. Appendix C provides a discussion of the laboratory testing program and applicable test results.

2.1. REGIONAL GEOLOGY

The project corridor is located in the northern portion of the Puget Sound Lowland of western Washington. The Puget Sound Lowland is an elongated topographic and structural depression bordered by the Cascade Mountains to the east and the Olympic Mountains on the west. This area has been repeatedly occupied by a lobe of the Cordilleran ice sheet, one of two continental glaciers, which developed during the recent ice ages of the Quaternary period. The most recent glacial advance and retreat, known as the Vashon Stade of Fraser Glaciation, occurred 13,500 to 20,000 years ago. The advancing ice sheet filled the Puget Lowlands with as much as 900 to 1500 meters (3,000 to 5,000 feet) of ice at least four different times during this period.

The Puget Sound area is underlain by a thick, complex sequence of glacial and interglacial sediments. Meltwater flowing from the advancing ice sheet transported a variety of sediment that built a broad outwash plain. Coarse sediment such as sand and gravel was deposited in the high-energy environment near the advancing glacier. Finer sediment such as silt and clay was deposited in the low-energy environment further from the glacier and in ponds and lakes that were formed as the advancing ice sheet blocked meltwater channels. As the ice sheet advanced, these sediments were overridden by hundreds of meters of ice and were compacted to their present condition. Following the last glacial advance and retreat, alluvial (river) and lacustrine (lake-bed) sediments were deposited by runoff from the eastern slopes of the Olympics. The more recent portions of these sediments (lower-energy) consist of fine-grained sands, silts, and clays.

As part of this study, we reviewed available geologic data for the project vicinity, including the *Geologic Map of the Bothell Quadrangle, Snohomish and King Counties, Washington* prepared by J. P. Minard in 1985. This map indicates the project vicinity is underlain by Vashon glacial units, including Glacial Till, Recessional Outwash, and Advance Outwash. More specifically, the southeast side of the interchange is mapped as containing Recessional Outwash. Recessional Outwash, the youngest deposit of the three, is deposited as the glaciers retreat and consequently has not been subjected to the compactive effort of thousands of vertical feet of ice. Recessional Outwash typically consists of medium dense, poorly graded sand, silty sand, and gravel. Slack-water deposits of fine sand and silt may also have "backfilled" the project site as the glaciers retreated.

2.2. SOIL CONDITIONS

Our exploration program consisted of 12 new test borings drilled to depths of up to 65 feet below the ground surface. Based on these explorations, the project site appears generally underlain by glacial deposits of Recessional Outwash, Advance Outwash and Glacial Till, consistent with the geologic map. Fill material, likely placed during original construction of SR-405 and the interchange, was observed at some locations. These units are further described below, in depositional sequence from youngest to oldest. The numbering sequence below is consistent with the units listed on Figure 3, Geologic Cross-Section A-A'.

- **Unit 1 - Fill**: Fill was observed in all of the test borings and generally consists of loose to dense, silty sand to poorly graded sand with silt and/or gravel. Typically, the fill was less than 10 feet thick.

- **Unit 2 – Recessional Outwash**: This unit was observed throughout the project site and extends to between 25 and 35 feet below the existing ground surface. The observed outwash unit typically consists of loose to medium dense, well graded to poorly graded sand with varying amounts of gravel, and silty sand.

  In some cases, loose to medium dense silt layers were observed near the base of this unit. While differing (in consistency) from the sandier outwash unit, the "slack-water" silt deposits were likely deposited at the onset of the glacial retreat. Similar to the more granular portions of the Recessional Outwash unit, this part of the deposit has not been overconsolidated by glacial ice.

- **Unit 3 – Glacial Till**: Below the recessional outwash, overconsolidated deposits of Vashon Till were observed. These deposits range from clean, poorly graded sands to cemented silty sand. This unit extended to the limits of most explorations, except for the shallow test holes (H-8 through H-12) that never penetrated the Unit 2 soils.

  This glacial unit can provide excellent foundation support, having characteristically low compressibility and high shear strength. Permeability through this unit is generally very low, depending on the amount of fine grained material.

- **Unit 4 – Advance Outwash**: This unit was observed in test holes H-3-05, H-5-05, H-6-05, and H-7-05 below the recessional outwash and/or glacial till. This unit generally consists of clean, poorly graded to well graded sand with varying amounts of fine gravel. Like Glacial Till, this unit is very dense, having been overridden by thousands of feet of glacial ice.

2.3. GROUNDWATER

Evidence of groundwater was observed in all of the test holes performed for this study. In general, groundwater was observed at the contact between the fill and recessional outwash units, or between 10 and 15 feet below the existing ground surface. Open stand pipe piezometers were installed in test holes H-2-05, H-6-05 and H-8-05. The groundwater depth was encountered during drilling and subsequent monitoring is included on the boring logs in Appendix B. It should be anticipated that the groundwater level may vary with time of year, amount of precipitation, and other factors.

3. SEISMOLOGICAL CONSIDERATIONS

3.1. DESIGN EARTHQUAKE PARAMETERS

Seismic activity in the Puget Lowland is largely attributed to the Cascadia subduction zone, where the Juan de Fuca oceanic plate is being thrust under the North America plate. In addition, shallow crustal faults are also considered to have caused sudden uplift and subsidence in the Puget Lowland. Recent investigations indicate a major fault is located through downtown Seattle, between Bainbridge Island and Issaquah, and is termed the "Seattle Fault." On the east side of Lake Washington, the fault is thought to roughly parallel Interstate 90. Geologic evidence indicates a large earthquake was generated along this fault structure approximately 1,100 years ago (Johnson, 1994).

While the seismicity of Washington is not as well understood as other areas of western North America, seismologists believe that the local subduction zone has created great interplate earthquakes in the past (Modified Mercalli Intensities up to VIII), and is capable of future great earthquakes (Atwater, 1987). Researchers speculate the Seattle Fault could produce earthquakes on the order of magnitude 7; however, the recurrence interval of such earthquakes is anticipated to be infrequent (i.e., thousands of years).

For seismic design, a peak bedrock acceleration coefficient of 0.30 is recommended, based on the 2002 US Geological Survey National Seismic Hazards Mapping project, which is cited in the latest version of the *Geotechnical Design Manual (GDM)*. The recommended acceleration coefficient is based on expected ground motion at the project site that has a 10 percent probability of exceedence in a 50-year period (475-year return period). Design response spectra presented in the AASHTO guide specifications for seismic design of highway bridges are considered appropriate for seismic design of the pedestrian bridge. A Type II Soil Profile response spectrum, with a Site Coefficient of 1.2 is recommended for seismic design.

For structures to be designed per the 2003 International Building Code (IBC), including the elevator/stair tower to the pedestrian bridge, Soil Site Class C should be used for seismic design.

3.2. SEISMIC HAZARDS

As part of our site evaluation and engineering analysis, we examined soil liquefaction potential and ground fault rupture hazards in the project vicinity. The site is situated about 15 miles north of the assumed Seattle Fault alignment. Based on this distance and the rate of recurrence on the Seattle Fault (thought to be on the order of thousands of years), it is our opinion that the risk of ground rupture associated with the Seattle Fault is very low. In closer proximity to the project site lies the Whidbey Island Fault. Current mapping by Blakely et al. (2004) based on LIDAR technology indicates confirmed fault scarps exist about 3½ miles northeast of the site, with "possible" faults scarps about 1.5 miles away. While these faults and related aeromagnetic lineaments are closer to the project site than the Seattle Fault, the rate of recurrence on this fault (considered to be on the order of thousands of years) and the

lack of confirmed scarps at the site, suggests the risk to ground faulting related to the Whidbey Island Fault is also low.

A more realistic risk facing the site structures is earthquake-induced soil liquefactions. Liquefaction is a phenomenon whereby saturated soil deposits temporarily lose strength and behave as a viscous fluid in response to cyclic loading. Soil types considered at the highest risk of liquefaction during a seismic event are loose sandy soils. Our analysis of test borings conducted for the pedestrian bridge indicates some potential for soil liquefaction. However, the soil layers impacted are very thin (a few feet thick) and are often discontinuous. Consequently, the impacts associated with soil liquefaction, specifically ground settlement, are considered manageable through bridge foundation design (see Section 4.1). Liquefaction mitigation for pond slopes and retaining walls less than 10 feet tall is not required per the WSDOT *Geotechnical Design Manual*.

4. GEOTECHNICAL DESIGN RECOMMENDATIONS

4.1. GENERAL

We understand the new pedestrian bridge will be designed using Load and Resistance Factor Design (LRFD) methodology. Based on the soil conditions observed during our field exploration program, the use of spread footings to support the structure has a limited application. The reason for this is that soil liquefaction, as discussed above, will affect the bearing support in some of the fill and recessional outwash units 10 to 15 feet below the ground surface. At these locations, it would appear more prudent to use deep foundations.

The lone exception is at Pier 7, where proposed bridge loads are relatively low, and soil conditions are better. At this location, we have provided design recommendations for both shallow spread footings and driven piles. For Piers 1 through 6, however, we recommend only using driven piles to support the pedestrian bridge.

Design recommendations for spread footings, including nominal resistances for service, strength, and extreme limit states are provided in Section 4.3. Recommendations for driven piles in Section 4.2 include Strength and Extreme Limit state axial resistances, and p-y input soil parameters for 18-inch and 24-inch diameter closed-ended steel pipe piles.

Two new retaining walls are required along the on-ramp to southbound SR-405. These walls are needed to widen the on-ramp and support new fill. Recommendations for wall design, including Structural Earth (SE) walls and conventional cantilevered concrete walls, are included in Section 4.4. Recommendations for pole foundations and the detention pond are also provided herein.

4.2. DRIVEN PILES

4.2.1. Axial Capacity

Driven pile capacities for nominal Strength (ultimate) and Extreme event limit states are provided on charts in Appendix D. The charts present capacities for 18-inch and 24-inch diameter closed-ended steel pipe piles. Since soil properties and engineering characteristics are similar at Piers 3 and 6, and at Piers 1, 2, 4 and 5, we have provided capacity charts for these two cases. A capacity chart for Pier 7 has also been provided for the driven pile option (18-inch only). The factored resistance can be calculated by multiplying the nominal resistance by the appropriate factors shown in Table 1. For the factors in Table 1, we have assumed pile resistance will be field verified using the WSDOT pile driving formula in the *Standard Specifications*. Axial reduction factors for group effects are not required because the proposed pile spacing is equal to or greater than 3D, where D equals the pile diameter.

The attached capacity charts do not include pile resistances for the Service Limit state. It is our opinion, provided the piles are driven to a minimum depth of 30 feet below the ground surface, total settlements should be less than 1.0 inch. The capacity charts do not account for the net weight of the piles, which should be added as a separate factored load when sizing the piles (for both compression and uplift cases). Uplift resistance can be equated to the nominal skin friction on the charts.

Table 1. Driven Pile Resistance Factors

Limit State	Resistance Factor ϕ	
	Bearing	**Uplift**
Strength	0.55	0.35
Extreme	1.00	1.00

Final minimum tip elevations should be determined by the structural engineer based on lateral loading requirements, as we anticipate lateral loading will govern pile length. However, the piles should be driven at least to the top of the Unit 3 soils (or Unit 4 soils if Unit 3 is not present).

Since soil conditions below 30 feet become very dense, we anticipate it will be difficult to penetrate into this glacial layer more than about 5 feet with closed-ended piles. Should the lateral analysis (see below) require deeper embedments, we should reevaluate our recommendations and, if necessary, provided capacity charts for non-displacement type driven piles or drilled shafts.

4.2.2. Lateral Analysis

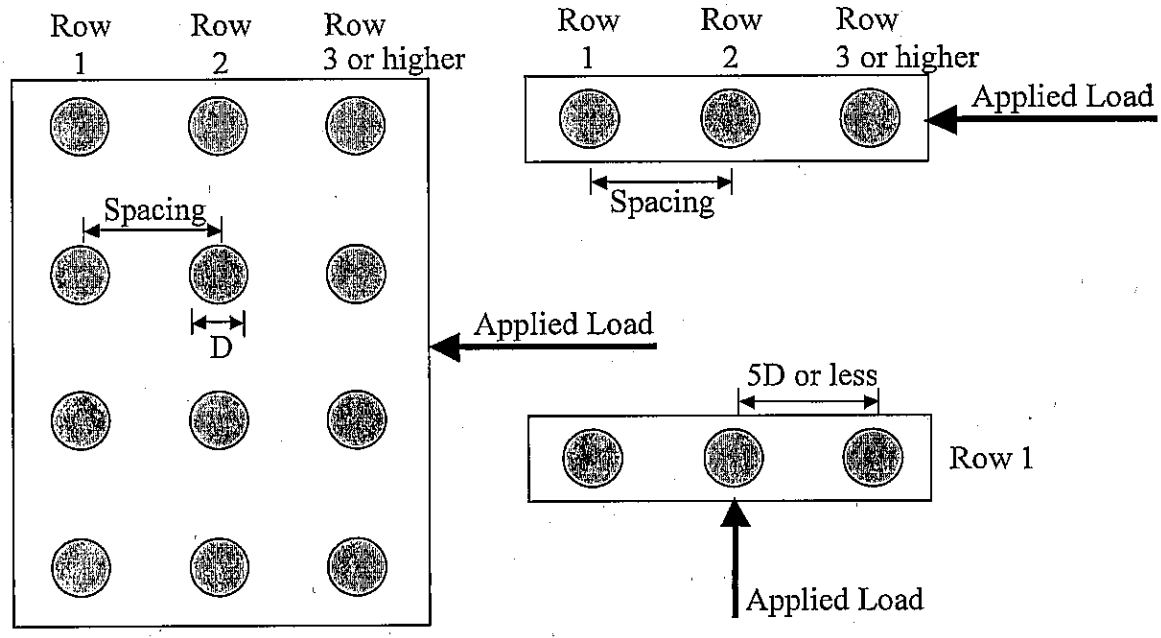
We understand lateral analyses of piles will be evaluated using the LPILE computer program (Reese and Wang, 1989) or S-Shaft program (J.P.Singh, 2003). P-y curve soil parameters

used for LPILE and S-Shaft input are presented in Appendix D. In addition to static soil stiffness parameters, we have provided seismic p-y parameters to account for the soil liquefaction scenario. Where piles are spaced closer than 6D the P multipliers, or P_m, should be applied to the p-values in the p-y curves developed using LPILE; the S-Shaft program directly accounts for group effects. The multipliers in Table 2 are a function of the center-to-center spacing expressed in multiples of the foundation element diameter (D) as measured along the direction of loading within the group.

Table 2. P Multipliers (averaged from Hannigan, 1997).

Center-to-Center spacing in the direction of loading	**P Multipliers**		
	Row 1	**Row 2**	**Row 3**
3D	0.70	0.50	0.35
5D	1.00	0.85	0.70

Loading direction and spacing are as defined in the following figure. Note that if the loading direction for a single row is perpendicular to the row (bottom right detail in the figure), a group reduction factor of less than 1.0 should only be used if the spacing is 5D or less, as shown in the detail.



4.2.3. Seismic Effects

As described earlier, intermittent layers of liquefaction-prone soils require usage of deep foundations to support 6 of the 7 bridge piers. At these locations, post-liquefaction downdrag loads could develop on the piles due to ground subsidence as the excess pore water pressures dissipate. The ultimate downdrag loads provided in the following table should be factored and added to the factored bridge loads when evaluating the extreme event limit state. These loads were calculated considering the static skin friction in the non-liquefiable zone (above the liquefiable layer) and the residual soil strength in the liquefiable zone.

Table 3. Downdrag Loads due to Liquefaction

Diameter	Downdrag Load (kips)		
	Pier 2	Pier 3	Pier 6
18-inch	36	43	68
24-inch	48	57	104

In addition to downdrag, pile resistances should be adjusted for the loss of skin friction in the liquefied zones. If the design is dependent on the Extreme Event Limit state, additional pile resistance will need to be used for estimating pile lengths and included in the Contract for pile driving. Skin friction loss due to liquefaction is shown in Table 4, and should be the capacity when using the attached design charts in Appendix D.

For example, an 18-inch diameter pile at Pier 3 may have to resist an Extreme Event loading of 400 kips (factored dead load, live load, and downdrag) per pile. From Table 4, this pile must be driven through a liquefiable zone which has a skin friction (within the zone and above) of 50 kips. To estimate the required pile length, simply divide 400 kips by the resistance factor of 0.55 from Table 1 and the 50 kips for the liquefiable zone skin friction. The contract should therefore be set up to have the piles driven to a resistance of 770 kips.

Table 4. Loss of Skin Friction due to Liquefaction

Diameter	Downdrag Load (kips)		
	Pier 2	Pier 3	Pier 6
18-inch	41	50	78
24-inch	58	69	120

4.3. SPREAD FOOTINGS

The conditions observed at the planned location for Pier 7 indicate the area is underlain by medium dense sands and silts. Providing utility conflicts do not exist, one option for support

of this abutment is to use low-capacity shallow spread footings (the option to use driven piles is discussed in Section 4.1). A chart of bearing resistance versus footing width is presented in Appendix D for Service, Strength, and Extreme Limit loading states. The Service Limit State curve is for footing resistances that correspond to less than 1 inch of settlement. The minimum embedment depth of the footing should be based on the requirements in the WSDOT Bridge Design Manual (BDM) for footings.

For the Extreme Limit State, we have calculated that there is a slight risk of partial soil liquefaction of a layer about 10 feet below the existing ground surface. However, should this layer liquefy, we estimate the spread footing would only settle an additional ½ inch during or immediately following the design seismic event. We consider this amount of deformation minor during a seismic event, but this should be evaluated more thoroughly by the Bridge & Structures Office.

For the other piers (1 through 6), we estimated much higher settlements due to soil liquefaction, and consequently prefer the use of driven piles to support the bridge at those locations.

We recommend the following resistance factors be used for spread footing design when evaluating the different limit states.

Table 5. Spread Footing Resistance Factors

Limit State	Resistance Factor ϕ		
	Shear Resistance to Sliding	**Bearing**	**Passive Pressure Resistance to Sliding**
Strength	0.80	0.45	0.50
Service	1.00	1.00	1.00
Extreme	1.00	1.00	1.00

Equivalent spring constants for the spread footing foundations should be determined by the method outlined in Section 7.2.4 of FHWA Report No. IP-87-6 titled: *Seismic Design and Retrofit for Highway Bridges.* The shear modulus and Poisson's ratio of the foundation soil must be estimated to calculate the equivalent spring constant using this method. Based on the results of our analysis, we have developed a range of shear modulus values for the soil unit under these subject spread footings. The most critical spring constant for the pier support depends on the rigidity of the superstructure. This is determined by the structural engineer. A range of shear modulus values are presented below, so as to determine which is more critical, a weak or stiff spring.

Table 6. Shear Modulus versus Foundation Soil Strain

Shear Modulus, G	Strain	Poisson's ratio, μ
280 to 850 tsf	0.2 to 0.02 %	0.35

4.4. RETAINING WALLS

Retaining walls planned for this project include abutment walls for the bridge and the two walls (A and B) along the southbound on-ramp to SR-405. Retaining walls A and B extend from Ramp Station 94+25 to 95+40, and from 98+52 to 99+95, respectively. Retaining wall A is off-set along the left fog line and has a maximum exposed height of about 1.5 feet, and retaining wall B is off-set along the right fog line and has a maximum exposed height of about 3.0 feet. Plan and profiles for retaining walls A and B are presented in Figures 4 and 5, respectively.

Based on the soil conditions at walls A and B, several retaining wall options exist. Some wall types may be more economical or geometrically suitable than others because of issues specific to the project site including, but not limited to, construction access, architectural/appearance, and traffic barrier attachment. We understand that the Project Team is pursuing conventional cantilevered concrete walls for both locations. For this application and height, this wall type can generally be economical.

Where non-Standard Plan cantilevered concrete walls are used, including non-standard barrier walls, retaining walls should be designed using the lateral earth pressure coefficients and soil parameters presented in the following table, in conjunction with the design methodology presented in the WSDOT *Bridge Design Manual.*

Table 7. Lateral Earth Pressure Coefficients and Soil Parameters

Parameter	Value
Backfill Unit Weight (γ)	130 pcf
Backfill Soil Friction Angle (ϕ_f)	36°
Active Earth Pressure (K_a)	0.26
Bearing Soil Friction Angle (ϕ_f)	38°
Passive Earth Pressure (K_p) - Unfactored	NA
Coefficient of Sliding	0.67
Nominal Bearing Capacity – Service Nominal Bearing Capacity – Service & Extreme	See Appendix D (Retaining Walls A & B)
Seismic Earth Pressure Coefficient (K_{ae})	0.35

The coefficient of sliding provided in Table 7 presumes that cast-in-place concrete construction will be used. Per the BDM, the lateral earth pressure due to traffic surcharge

loading could be calculated using a uniformly distributed load at the ground surface of 250 psf, multiplied by K_a (K_a x 250 psf), or 65 psf.

These walls should be designed using LRFD methodology. Resistance factors for designing these walls for the Service, Strength, and Extreme Limit states are provided in Table 5.

4.5. BRIDGE EMBANKMENTS

A bridge approach embankment is planned in the vicinity of Pier 7 and is estimated to be approximately 10 feet high (maximum). Based on our test boring, we estimate post-construction settlement of new embankments will not exceed 1 inch, providing the subgrade is prepared as described in Section 2-06.3(1) of the 2004 WSDOT Standard Specifications. We estimate nearly all of the settlement will occur during and immediately following placement of the new fill.

Provided embankments are constructed as described in the Standard Specifications, embankment slopes no steeper than 2H:1V will have an acceptable factor of safety against global slope failure during static and seismic conditions.

4.6. PONDS

Improvements are planned to the existing pond to maintain and control stormwater run-off. Under normal conditions, ponds retain the stormwater and allow sediment to fall out of suspension before exiting a pond or series of ponds. During large storm events, the same ponds provide additional storage capacity. In some cases, the pond design allows for some surface water infiltration, as this allows for larger treatment and retention volumes. If some stormwater can infiltrate into the ground, the result can lead to smaller pond sizes, smaller discharge pipes and, in general, reduce the size of the proposed facility.

At the project interchange, test holes H-8-05, H-9-05 and H-11-05 encountered groundwater at a depth of approximately 5 feet below the existing ground surface (or less). The presence of groundwater above the base of the proposed pond indicates very little additional reservoir capacity will be obtained using the currently proposed pond elevations. The Department of Ecology's (DOE) Stormwater Management Manual has guidelines that preclude "infiltration" type ponds where the groundwater is within 5 feet of the base of the infiltration pond or gallery. As such, soil infiltration values have not been included herein.

We recommend pond side slopes be graded at 2H:1V or flatter. Our experience and geotechnical analyses of embankments with 2H:1V side slopes in the project's soil types suggest a factor of safety against global stability in excess of 1.5. If and where new embankment fills are planned in the vicinity of the ponds, the new fill should be compacted using Method B.

4.7. SIGN & SIGNAL POLE FOUNDATIONS

Two cantilevered signal poles are planned along the southbound on-ramp to SR-405, one at the ramp intersection with SR-527 and one at the ramp meter. Test holes H-10-05 and H-12-05 were drilled in the immediate vicinity of these planned signal locations. Based on the soil conditions encountered during the site investigation, pole foundations may be designed using "Standard Plan" foundations. Allowable lateral soil bearing pressures for selection of standard plan foundations are presented in Table 8.

Table 8. Pole Foundations

Signal Location	Related Test Boring	Special Design Required?	Standard Plan "Design" - Allowable Lateral Soil Bearing Pressure
Ramp Meter	H-12-05	No	1000 psf
SR-527 Intersection	H-10-05	No	2500 psf

Groundwater should be expected during construction of the ramp meter signal pole foundation. At this location, groundwater was observed during test drilling at a depth of 5 feet below the existing ramp pavement. The soil conditions below the water table include loose, clean sandy soils which are susceptible to caving and "running." The foundation contractor should be prepared to use temporary casing and/or drilling slurry to maintain the sidewalls of the excavation.

5. CONSTRUCTION CONSIDERATIONS

At the request of the Bridge Office, we have reviewed the pile group settlement and driveability. Our recommendations and analysis are based on the pile tip elevations, pier configurations, and unfactored service dead and live loads supplied to us by the Bridge Office. If this information changes we should be contacted in order to revise the following recommendations:

- Based on our settlement analysis, the piers are expected to settle less than 1 inch, and we expect the majority of the settlement to be relatively immediate.
- Based on our driveability analysis, it is possible to drive 24-inch diameter, A36 or A45 steel pipe piles with a wall thickness of 0.5" to the proposed tip elevation. However, localized damage to the top of the pile is expected in order to reach the specified tip elevation. If the soils are similar to those observed in the test borings, the pile should sustain little to no damage due to the driving operation through the upper sand layers. It is possible that when the pile tip reaches the glacial till layer the top of the pile may begin to roll or mushroom, at this point pile driving operations should conclude. In our opinion, the pile tip will not penetrate into the underlying glacial till layer (approximately 30' below the existing ground). We

expect that the piles will need to be cut at the pile cap elevation, thus removing the likely damaged area of the pile. If overdriving is required to achieve the minimum tip elevations, this should be indicated in the Special Provisions.

We understand the project office requires geotechnical input for planning and cost estimating structure excavation. For these purposes only, we have assessed the soil type for structure excavation and it is our opinion that the site soils are Type C soils. For this classification, contractors may be able to make temporary excavations no steeper than 1.5H:1V. It should be noted the contractor is responsible for the stability of all temporary excavations.

APPENDIX A – FIGURES

APPENDIX B - FIELD EXPLORATIONS

FIELD EXPLORATIONS

WSDOT's field exploration program for the Canyon Park Freeway Station project consisted of drilling 12 exploratory borings. Geotechnical drilling was performed using a CME 850 track-mounted drilling rig and a CME-55 truck-mounted drill rig. Test holes were advanced to depths up to 65 feet below the ground surface principally using mud rotary drilling methods. At each location, soil samples were obtained using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM D-1586. SPTs are obtained by driving a 2-inch outside diameter split-spoon sampler 18-inches into the soil with a 140-pound hammer. The number of blows required to achieve 6 inches of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 12 inches of penetration. Each drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammers on these two drill rigs are rated at approximately 75 percent efficiency, as compared to approximately 60 percent for manual hammers.

Soil samples were submitted to the E&EP Materials Laboratory, and selected samples were laboratory tested.

APPENDIX C - LABORATORY TESTING

APPENDIX A – FIGURES

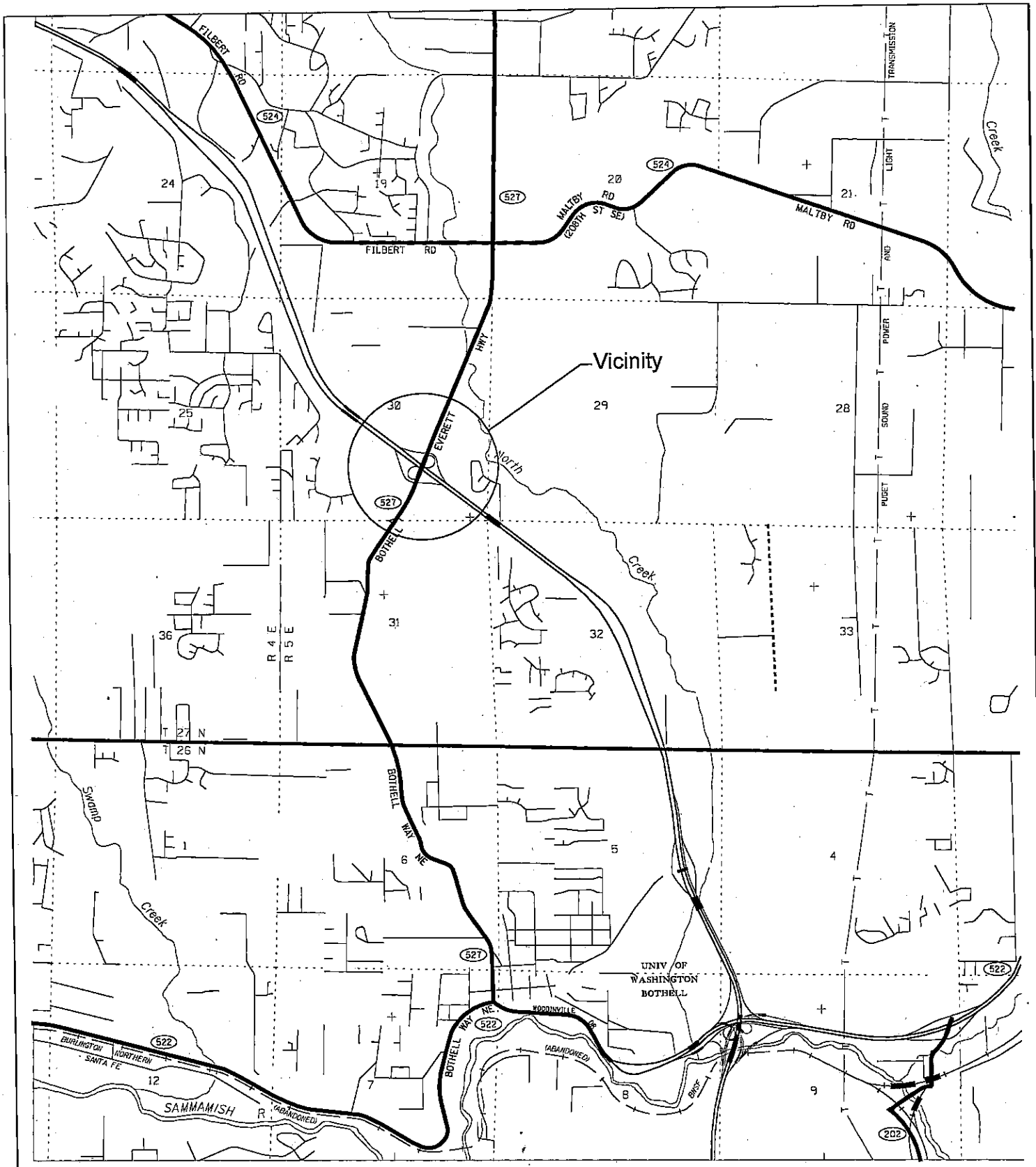


Figure 1: Site Map

JOB XL-2406 S.R. 405 C.S. 3111 LAYOUT

Canyon Park Freeway Station Pedestrian Bridge

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 6/2005
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY WM

...\reliefmap.dgn 12/8/2005 10:42:04 AM

AL4 100+98.64 P.T.=
2J 663+21.25 (9.27' LT)

EAST SR-527

DL4 98+80.58=
2J 662+20.21 (0.02' RT)
DL4 100+43.12 P.C.
N 67°13'20" W
DL4 LINE

BUS 35+65.63 (21.20') LT
END RETAINING WALL B

BUS 34+10.98 (18.25') LT
BEGIN RETAINING WALL B

AL4 96+99.96 P.C.

H-10-05

CL4 107+52.25
P.C.C.

CL4 108+55.32 P.T.=
2J 660+97.53
(44.86' RT)

AL4 95+40 (38.50') LT
END RETAINING WALL A

AL4 94+24.95 (34.39') LT
BEGIN RETAINING WALL A

AL4 96+72.49 P.T.

N 78°28'13" W

H-1-05

H-12-05

AL4 94+40.49 P.C.C.

H-2-05

A'

H-3-05

AL4 91+38.11 P.C.=
L 1011+09.02 (96.05' LT)

AL4 LINE

H-4-05

90+00

N 52°00'40" W

CL4 LINE

89 P.C.

90+26.06 P.T.

SOUTH SR-405

H-5-05

1010+00

N 52°00'40" W

L LINE

I-405

NORTH SR-405

1020+00

WEST SR-527

2J LINE SR527

CL4 101+79.61 P.C.

N 52°00'22" W

BR4 LINE
N 52°00'34" W

90+00

N 52°00'28" W

AR4 LINE

AR4 93+02.80 P.C.

H-6-05

H-8-05

H-11-05

H-7-05

Pond

H-9-05

BR4 19+68.72 P.T.

Park and Ride Lot

A

AR4 97+44.70 P.T.

N 13°21'05" W

BR4 12+93.28 P.C.=
2J 665+77.70 (14.12' LT)

BR4 13+97.02 P.C.C.

H-8-05 Test Hole Designation and Approximate Location

Geologic Cross-Section A-A

JOB XL-2406 S.R. 405 C.S. 3111

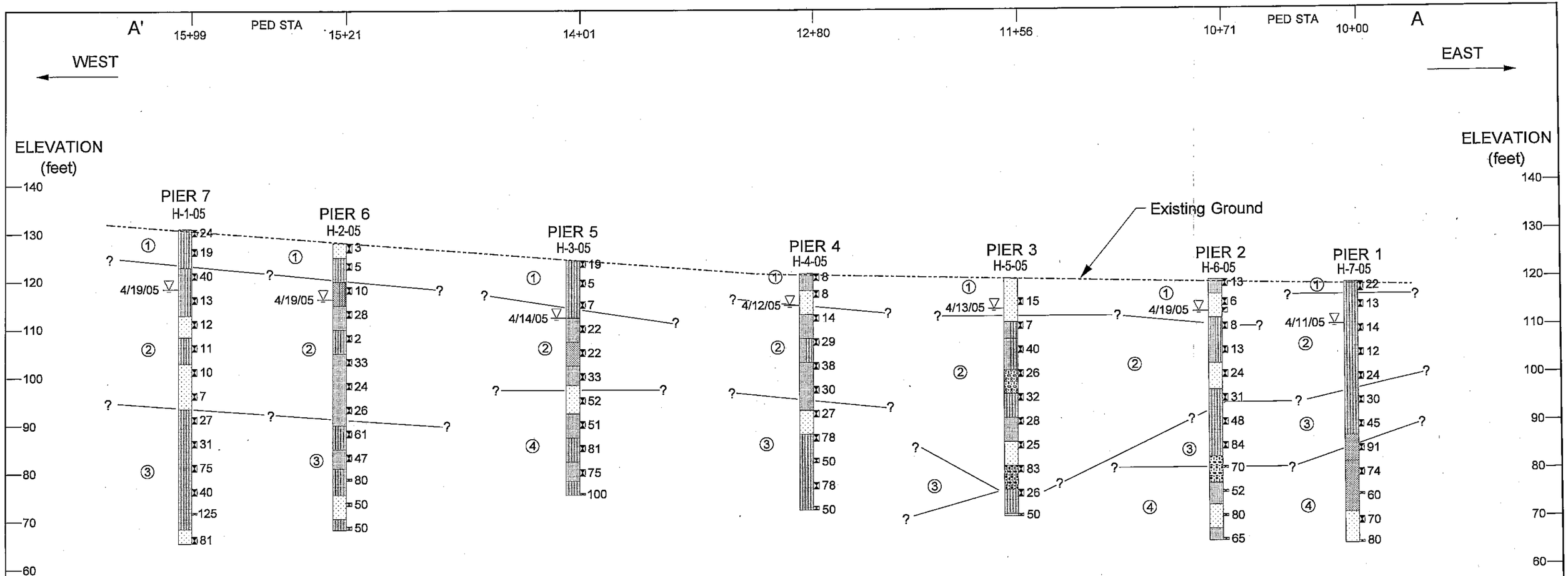
Canyon Park Freeway Station Pedestrian Bridge

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 6/2005
SCALE 1=100' VERT.
1=100' HORIZ.
SHEET ___ OF ___
DRAWN BY WM

Figure 2: Site and Exploration Plan

...\B-topo2.dgn 12/8/2005 1:53:45 PM



Geologic Units

① FILL - Loose to medium dense, poorly graded SAND to sandy SILT

② RECESSIONAL OUTWASH - Medium dense to dense, poorly graded SAND to sandy SILT to silty GRAVEL

③ GLACIAL TILL - Dense to very dense, silty SAND with gravel

④ ADVANCE OUTWASH - Very dense, well graded SAND with gravel to poorly graded GRAVEL with sand.

TEST HOLE LEGEND

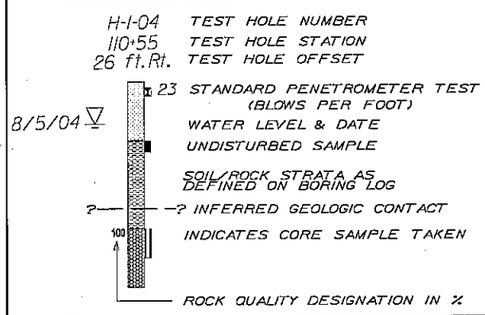


Figure 3: Geologic Cross-Section A-A'

JOB XL-2406 S.R. 405 C.S. 3111

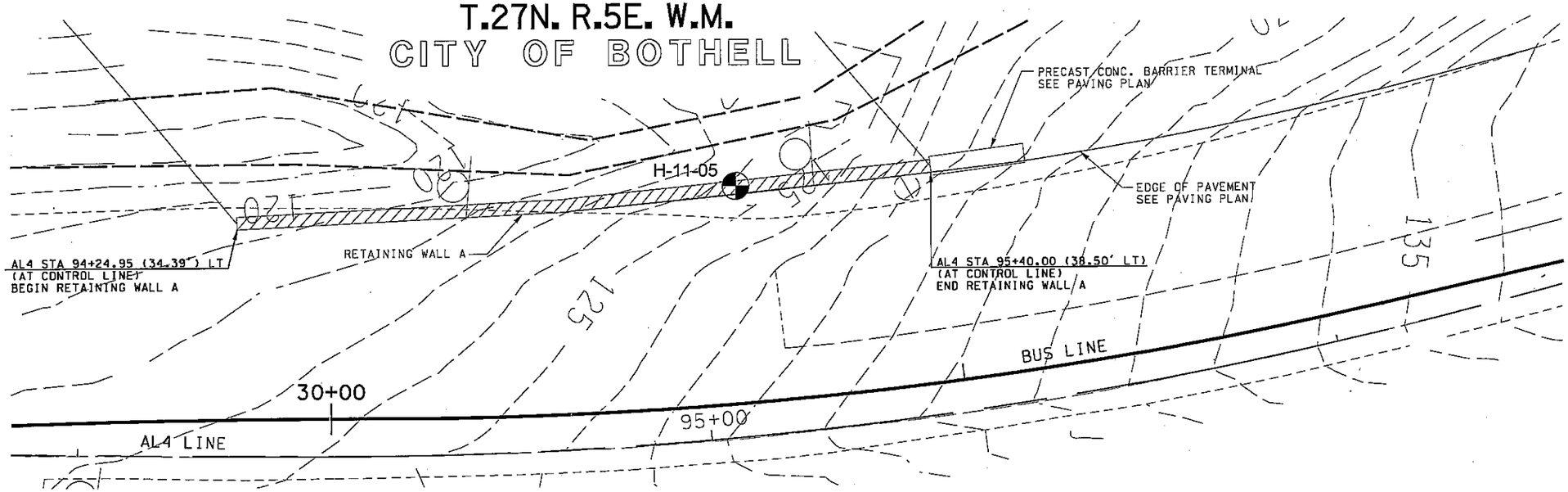
Canyon Park Freeway Station

WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
T. E. BAKER STATE MATERIALS ENGINEER

DATE 6/2005
SCALE 1=20' VERT.
N.T.S. HORIZ.
SHEET ___ OF ___
DRAWN BY WM

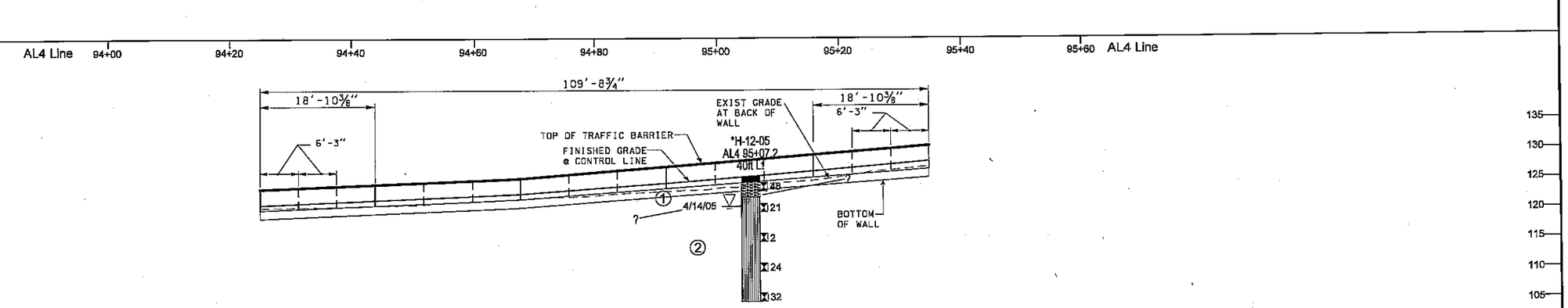
...\B-topo2.dgn 12/8/2005 10:37:03 AM

T.27N. R.5E. W.M.
CITY OF BOTHELL



GENERAL NOTES:

1. STATION, OFFSET, AND ELEVATION ARE AT THE WALL CONTROL LINE, SEE TYPICAL WALL SECTION ON RWD1 FOR LOCATION OF CONTROL LINE
2. FOR LOCATION OF WALL A, SEE VICINITY MAP.



*Station and Offset are Approximate

TEST HOLE LEGEND

H-I-04 TEST HOLE NUMBER
110+55 TEST HOLE STATION
26 ft.Rt. TEST HOLE OFFSET
23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
8/5/04 WATER LEVEL & DATE
UNDISTURBED SAMPLE
SOIL/ROCK STRATA AS DEFINED ON BORING LOG
? ? INFERRED GEOLOGIC CONTACT
INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION IN %
DATUM (NAVD) 88

Geologic Units

(1) FILL - Loose to medium dense, poorly graded SAND to sandy SILT

(2) RECESSIONAL OUTWASH - Medium dense to dense, poorly graded SAND to sandy SILT to silty GRAVEL

Figure 4: Retaining Wall A Plan and Profile

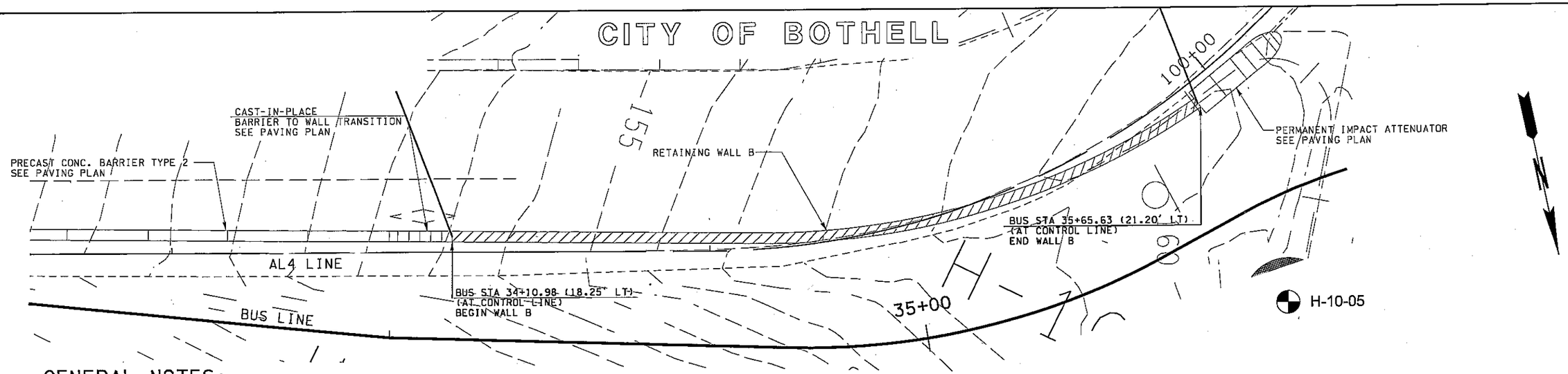
JOB XL-2406 S.R. 405 C.S. 3111

Canyon Park Freeway Station

WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
T. E. BAKER STATE MATERIALS ENGINEER

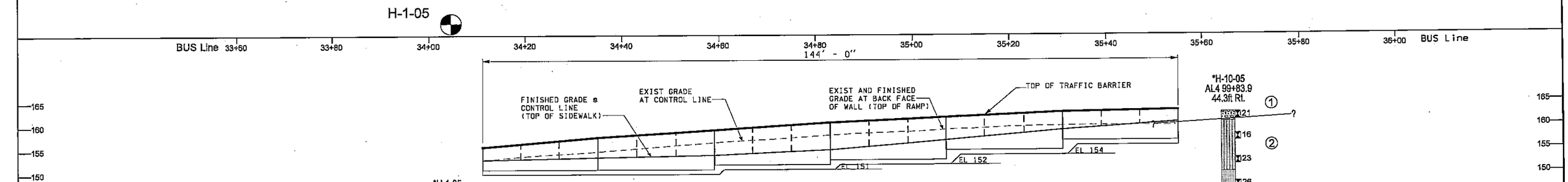
DATE 6/2005
SCALE 1=20' VERT.
1=20' HORIZ.
SHEET ___ OF ___
DRAWN BY WM

...\rwcp01.dgn 12/8/2005 2:16:13 PM



GENERAL NOTES:

1. STATION, OFFSET AND ELEVATION ARE AT THE FINISHED GRADE AT THE CONTROL LINE. SEE TYPICAL WALL SECTION ON RWD2 FOR LOCATION OF CONTROL LINE.
2. FOR LOCATION OF WALL B SEE VICINITY MAP.
3. SEE BARRIER DUMMY JOINT DETAIL ON RWD1



*Station and Offset are Approximate

TEST HOLE LEGEND

- H-I-04 — TEST HOLE NUMBER
- 110+55 — TEST HOLE STATION
- 26 ft.Rt. — TEST HOLE OFFSET
- 23 — STANDARD PENETROMETER TEST (BLOWS PER FOOT)
- 8/5/04 ▽ — WATER LEVEL & DATE
- UNDISTURBED SAMPLE
- SOIL/ROCK STRATA AS DEFINED ON BORING LOG
- ? — ? INFERRED GEOLOGIC CONTACT
- 130 — INDICATES CORE SAMPLE TAKEN
- ROCK QUALITY DESIGNATION IN %

DATUM (NAVD) 88

Geologic Units

1. FILL - Loose to medium dense, poorly graded SAND to sandy SILT
2. RECESSIONAL OUTWASH - Medium dense to dense, poorly graded SAND to sandy SILT to silty GRAVEL
3. GLACIAL TILL - Dense to very dense, silty SAND with gravel

Figure 5: Retaining Wall B Plan and Profile

JOB XL-2406 S.R. 405 C.S. 3111

Canyon Park Freeway Station

WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
MATERIALS LABORATORY
T. E. BAKER STATE MATERIALS ENGINEER

DATE 6/2005
SCALE 1=20' VERT.
1=20' HORIZ.
SHEET ____ OF ____
DRAWN BY WM

...\rwcp02.dgn 12/8/2005 2:35:40 PM

APPENDIX B - FIELD EXPLORATIONS

FIELD EXPLORATIONS

WSDOT's field exploration program for the Canyon Park Freeway Station project consisted of drilling 12 exploratory borings. Geotechnical drilling was performed using a CME 850 track-mounted drilling rig and a CME-55 truck-mounted drill rig. Test holes were advanced to depths up to 65 feet below the ground surface principally using mud rotary drilling methods. At each location, soil samples were obtained using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM D-1586. SPTs are obtained by driving a 2-inch outside diameter split-spoon sampler 18-inches into the soil with a 140-pound hammer. The number of blows required to achieve 6 inches of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 12 inches of penetration. Each drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammers on these two drill rigs are rated at approximately 75 percent efficiency, as compared to approximately 60 percent for manual hammers.

Soil samples were submitted to the E&EP Materials Laboratory, and selected samples were laboratory tested.

Washington State Department of Transportation

Test Boring Legend

Sampler Symbols

	Standard Penetration Test
	Oversized Penetration Test (Dames & Moore, California)
	Shelby Tube
P	Piston Sample
	Washington Undisturbed
	Vane Shear Test
	Core
	Becker Hammer
B	Bag Sample

Well Symbols

	Cement Surface Seal
	Piezometer Pipe in Granular Bentonite Seal
	Piezometer Pipe in Sand
	Well Screen in Sand
	Granular Bentonite Bottom Seal
	Inclinometer Casing in Concrete Bentonite Grout

Laboratory Testing Codes

UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
UC	Unconfined Compression Test
DS	Direct Shear Test
CN	Consolidation Test
GS	Grain Size Distribution
MC	Moisture Content
SG	Specific Gravity
OR	Organic Content
DN	Density
AL	Atterberg Limits
PT	Point Load Compressive Test
SL	Slake Test
DG	Degradation
LA	LA Abrasion

Soil Density Modifiers

Gravel, Sand & Non-plastic Silt		Elastic Silts and Clay	
SPT Blows/ft	Density	SPT Blows/ft	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-24	Medium Dense	5-8	Medium Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

Angularity of Gravel & Cobbles

Angular	Coarse particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Coarse graine particles are similar to angular but have rounded edges.
Subrounded	Coarse grained particles hav nearly plane sides but have well rounded corners and edges.
Rounded	Coarse grained particles have smoothly curved sides and no edges.

Soil Moisture Modifiers

Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

Soil Structure

Stratified	Alternating layers of varying material or color at least 6mm thick; note thickness and inclination.
Laminated	Alternating layers of varying material or color less than 6mm thick; note thickness and inclination.
fissured	Breaks along definite planes of fracture with little resistance to fracturing..
Slickensided	Fracture planes appear polished or glossy, somtimes stiated.
Blocky	Cohesive soil that can be broken down into smaller angular lumps which resist further breakdown.
Disrupted	Soil Structure is broken and mixed. Infers that material has moved substantially - landslide debris.
Homogeneous	Same color and appearance throughout.

HCL Reaction

No HCL Reaction	No visible reaction.
Weak HCL Reaction	Some reaction with bubbles forming slowly.
Strong HCL Reaction	Violent reaction with bubbles forming imediately.

Degree of Vesicularity of Pyroclastic Rocks

Slightly Vesicular	5 to 10 percent of total
Moderately Vesicular	10 to 25 percent of total
Highly Vesicular	25 to 50 percent of total
Scoriaceous	Greater than 50 percent of total

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-1-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 141.0 ft (43.0 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller Vince Johnson Lic# 2532

Site Address Vic. of SR 405 and SR 527 Inspector Brian Hilts

Start April 19, 2005 Completion April 19, 2005 Well ID# Equipment CME 850 w/ autohammer

Station AL4 98+40 Offset 50' RT Casing HWT/HQ Method Wet Rotary

Northing 620811.1 Easting 1629759.2 Latitude Longitude

County Snohomish Subsection SW 1/4 SE 1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				2 12 12 (24)		D-1	GS MC	SM, M.C. = 9% Silty SAND with gravel, sub rounded, medium dense, grayish brown, moist. Top 0.5' very dark brown with hair roots. bottom 0.9' grayish brown with FeO stains. Length Recovered 1.4 ft, Length Retained 1.4 ft (FILL)		
5	1			6 8 11 (19)		D-2		Silty SAND, medium dense, dark grayish brown, moist, bottom 0.5' with some gravel. Length Recovered 1.2 ft, Length Retained 1.2 ft		
10	2 3			17 20 20 (40)		D-3		Poorly graded SAND, dense, gray, moist, Homogeneous, HCl reaction not tested, 5.0' to 9.0' scattered gravels demo by drilling. Length Recovered 1.5 ft, Length Retained 1.5 ft. (RECESSIONAL OUTWASH)	▽ 04/19/2005	
15	4 5			4 6 7 (13)		D-4	GS MC	SP-SM, M.C. = 28% Poorly graded SAND with silt, medium dense, gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft, Length Retained 1.0 ft		
20	6			5 6		D-5	GS MC	ML, M.C. = 28% Sandy SILT, medium dense, grayish brown, wet.		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:25 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

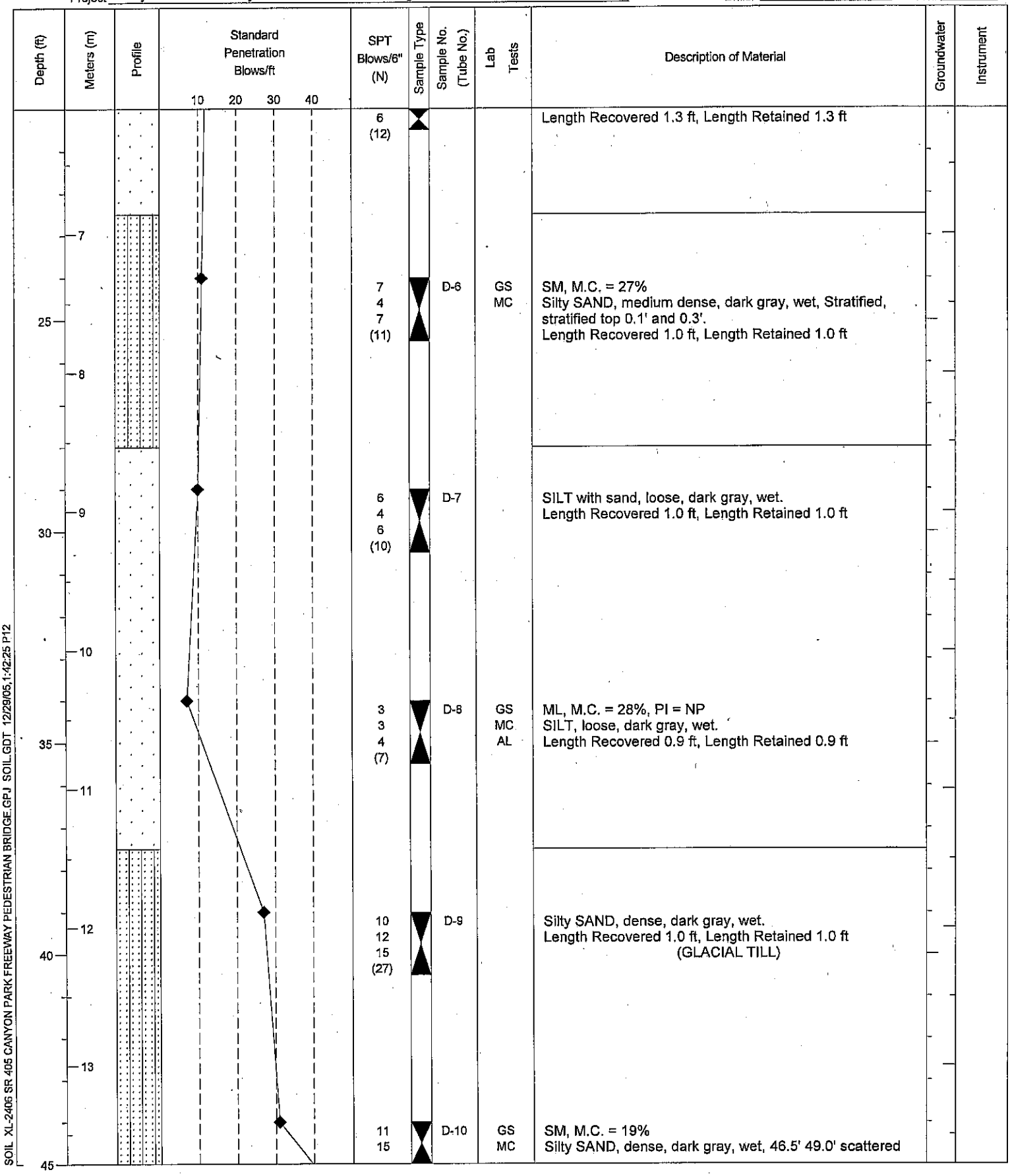
HOLE No. H-1-05

Job No. XL-2406 SR 405 Elevation 141.0 ft (43.0 m)

Sheet 2 of 3

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532



SPT Blows/6" (N)	Sample No. (Tube No.)	Lab Tests	Description of Material
6 (12)			Length Recovered 1.3 ft, Length Retained 1.3 ft
7 4 7 (11)	D-6	GS MC	SM, M.C. = 27% Silty SAND, medium dense, dark gray, wet, Stratified, stratified top 0.1' and 0.3'. Length Recovered 1.0 ft, Length Retained 1.0 ft
6 4 6 (10)	D-7		SILT with sand, loose, dark gray, wet. Length Recovered 1.0 ft, Length Retained 1.0 ft
3 3 4 (7)	D-8	GS MC AL	ML, M.C. = 28%, PI = NP SILT, loose, dark gray, wet. Length Recovered 0.9 ft, Length Retained 0.9 ft
10 12 15 (27)	D-9		Silty SAND, dense, dark gray, wet. Length Recovered 1.0 ft, Length Retained 1.0 ft (GLACIAL TILL)
11 15	D-10	GS MC	SM, M.C. = 19% Silty SAND, dense, dark gray, wet, 46.5' 49.0' scattered

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:25 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-1-05

Job No. XL-2406 SR 405 Elevation 141.0 ft (43.0 m)

Sheet 3 of 3

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				16 (31)				small gravels demo by drilling. Length Recovered 1.2 ft, Length Retained 1.2 ft		
	14									
	15		>>	20 37 38 (75)		D-11		Silty SAND, very dense, dark gray, wet, stratified with sandy silt with some gravel. Length Recovered 1.3 ft, Length Retained 1.3 ft		
50										
	16									
				11 15 25 (40)		D-12		Silty SAND, dense, dark gray, wet, with some gravel. Length Recovered 1.2 ft, Length Retained 1.2 ft		
55	17									
	18		>>	125/4" (125/4")		D-13		Silty SAND with gravel, angular, very dense, dark gray, moist. Length Recovered 0.4 ft, Length Retained 0.4 ft		
60										
	19									
			>>	35 38 43 (81)		D-14		SILT, very dense, dark gray, dry, laminated with sand lenses. Length Recovered 1.5 ft, Length Retained 1.5 ft		
65	20									
								End of test hole boring at 65.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Coordinates and elevations are from survey. Station and offset are approximate.		
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:25 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-2-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 138.1 ft (42.1 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller Vince Johnson Lic# 2532

Site Address Vic. of SR-405 and SR-527 Inspector Brian Hilts

Start April 18, 2005 Completion April 18, 2005 Well ID# AHN-949 Equipment CME 850 w/ autohammer

Station AL4 97+60 Offset 40' RT Casing 4"x62' Method Wet Rotary

Northing 620769.6 Easting 1629702.1 Latitude Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 1 2 4 (3)		D-1		Sandy SILT, organics, very loose, dark brown, moist. Organics throughout with some hair roots. Length Recovered 1.3 ft, Length Retained 1.3 ft		
	1			6 3 2 (5)		D-2		Silty SAND, loose, brown, moist, with a trace of gravel. Length Recovered 0.8 ft, Length Retained 0.8 ft (FILL)		
5	2									
				5 6 4 (10)		D-3	GS MC	SW-SM, M.C. = 17% Well graded SAND with silt, loose, dark gray, moist, to wet, with some gravel. Length Recovered 0.9 ft, Length Retained 0.9 ft	▽ 04/19/2005	
10	3									
	4			14 14 14 (28)		D-4		Poorly graded SAND, dense, dark gray, wet, some gravel and a trace of dark brown organics. Length Recovered 0.9 ft, Length Retained 0.9 ft		
15	5									
				1 1		D-5	GS MC	SM, M.C. = 22% Silty SAND, very loose, brown, wet. At 22.5' we		
20	6									

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05 1:42:27 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-2-05

Sheet 2 of 3

Job No. XL-2406 SR 405 Elevation 138.1 ft (42.1 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 (2)				encountered gravels demonstrated by drilling. Length Recovered 1.3 ft, Length Retained 1.3 ft		
	7			13 15 18 (33)		D-6		Poorly graded SAND with gravel, dense, reddish brown, wet. With FeO stains throughout. Length Recovered 1.2 ft, Length Retained 1.2 ft RECESSIONAL OUTWASH)		
25	8									
	9			10 12 12 (24)		D-7		Poorly graded SAND with gravel, medium dense, grayish brown, wet. Length Recovered 0.8 ft, Length Retained 0.8 ft		
30	10									
				7 12 14 (26)		D-8		Poorly graded SAND, dense, dark gray, wet. Length Recovered 1.2 ft, Length Retained 1.2 ft		
35	11									
	12		>>	19 31 30 (61)		D-9	GS MC	SM, M.C. = 12% Silty SAND with gravel, very dense, dark gray, wet. Length Recovered 1.3 ft, Length Retained 1.3 ft		
40	13									
				12 18		D-10		Poorly graded SAND with gravel, dense, dark gray, wet, with some silt.		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:27 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-2-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 138.1 ft (42.1 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				29 (47)				Length Recovered 0.7 ft, Length Retained 0.7 ft		
	14							GLACIAL TILL)		
	15		>>	80/6" (80/6")	D-11			Silty SAND, very dense, dark gray, wet, with a trace of gravel. Length Recovered 0.5 ft, Length Retained 0.5 ft		
50										
	16									
				45 50/3" (50/3")	D-12		GS MC	ML, M.C. = 19% Sandy SILT, very dense, dark gray, wet. Length Recovered 0.6 ft, Length Retained 0.6 ft		
55	17									
	18			45 50/3" (50/3")	D-13			Silty SAND, very dense, dark gray, wet, Stratified, HCl reaction not tested, With a trace of gravel and the bottom .1' was sandy silt. Length Recovered 0.7 ft, Length Retained 0.7 ft		
60								End of test hole boring at 59.8 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	19							Bailed the hole to 49.8'. We then installed a piezometer. The next day the water table was at 11.7'.		
65	20							Coordinates and elevations are from survey. Station and offset are approximate.		
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05 1:42:27 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-3-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 133.0 ft (40.5 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller Vince Johnson Lic# 2532

Site Address Vic. of SR-405 and SR-527 Inspector Brian Hilts

Start April 13, 2005 Completion April 14, 2005 Well ID# Equipment CME 850 w/ autohammer

Station AL4 96+45 Offset 25' RT Casing 6"x7" 4"x52' Method Wet Rotary

Northing 620719.1 Easting 1629632.7 Latitude Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 8 11 (19)		D-1	pH Res	Silty SAND with gravel, angular, medium dense, grayish brown, moist. The top 0.4' with some asphalt. Length Recovered 1.5 ft, Length Retained 1.5 ft (FILL)		
5	1			4 3 2 (5)		D-2	pH Res	Silty SAND, loose, dark gray, moist, with some gravel. The top 0.2' was brown in color. Length Recovered 1.0 ft, Length Retained 1.0 ft		
10	3			3 3 4 (7)		D-3		Silty SAND, loose, grayish brown, wet, with some gravel and a trace of dark brown organics. Possibly water zone area. Length Recovered 1.0 ft, Length Retained 1.0 ft	▽ 04/14/2005	
15	4 5			8 10 12 (22)		D-4		Poorly graded SAND, medium dense, dark gray, moist, with some gravel. Length Recovered 1.3 ft, Length Retained 1.3 ft (RECESSIONAL OUTWASH)		
20	6			8 11 11 (22)		D-5		Well graded SAND with gravel, medium dense, dark gray, wet. Length Recovered 1.4 ft, Length Retained 1.4 ft		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-3-05

Job No. XL-2406 SR 405 Elevation 133.0 ft (40.5 m)

Sheet 2 of 3

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7			10 15 18 (33)		D-6		Poorly graded SAND, dense, dark gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.3 ft, Length Retained 1.3 ft		
25	8									
			>>	10 20 32 (52)		D-7	GS MC	ML, M.C. = 21% Sandy SILT, very dense, dark gray, wet. The top 1.1' was sandy silt and the botton 0.4' was poorly graded sand with gravel. At 29.5' we encountered gravels demonstrated by drilling. Length Recovered 1.5 ft, Length Retained 1.5 ft (ADVANCE OUTWASH)		
30	9									
	10		>>	20 27 24 (51)		D-8		Poorly graded SAND with gravel, very dense, dark gray, wet, Stratified, HCl reaction not tested, Stratified with silty sand. Length Recovered 1.2 ft, Length Retained 1.2 ft		
35	11									
			>>	20 31 50/5" (81/11")		D-9		Silty SAND with gravel, very dense, dark gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.2 ft, Length Retained 1.2 ft		
40	12									
	13		>>	27 38 37 (75)		D-10		Poorly graded SAND, very dense, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.4 ft, Length Retained 1.4 ft		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-3-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 133.0 ft (40.5 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
			>>	100/5" (100/5")		D-11		Silty SAND with gravel, very dense, dark gray, wet. Length Recovered 0.4 ft, Length Retained 0.4 ft		
	15									
50								End of test hole boring at 48.9 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	16							The water table inside the casing after drilling was at 8.7'. Bailed the hole to 45.5', and 20 min. later the water table was at 38.6'. We tripped out the casing and the hole stayed open to 38.5'. The water table was at 11.9'.		
55										
	17							Coordinates and elevations are from survey. Station and offset are approximate.		
	18									
60										
	19									
65										
	20									
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-4-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 126.8 ft (38.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Site Address Vic. of SR-405 and SR-527

Inspector Brian Hilts

Start April 12, 2005 Completion April 12, 2005 Well ID#

Equipment CME 850 w/ autohammer

Station AL4 95+30 Offset 20' RT Casing 6"x17' 4"x52'

Method Wet Rotary

Northing 620646.1 Easting 1629532.3 Latitude Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 3 5 (8)		D-1		Poorly graded SAND with gravel, loose, grayish brown, moist, Homogeneous, HCl reaction not tested, The top .3' with hair roots. Length Recovered 1.3 ft, Length Retained 1.3 ft (FILL)		
5	1			2 3 5 (8)		D-2	pH Res	SILT, loose, dark gray, moist, Stratified, HCl reaction not tested, The top .2' was brown in color, the bottom .9' was gray, and from 4.4' to 4.5' it was sand with gravel. Length Recovered 1.1 ft, Length Retained 1.1 ft	▽ 04/12/2005	
10	2 3			7 7 7 (14)		D-3	pH Res	Poorly graded SAND, medium dense, grayish brown, wet. Length Recovered 0.8 ft, Length Retained 0.8 ft (RECESSIONAL OUTWASH)		
15	4 5			6 12 17 (29)		D-4	GS MC	SP-SM, MC=11% Poorly graded SAND with silt and gravel, dense, dark gray, wet. Length Recovered 1.1 ft, Length Retained 1.1 ft		
20	6			17 19 19 (38)		D-5		Poorly graded SAND with gravel, dense, dark gray, wet. Length Recovered 1.1 ft, Length Retained 1.1 ft (RECESSIONAL OUTWASH)		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-4-05

Sheet 2 of 3

Job No. XL-2406 SR 405 Elevation 126.8 ft (38.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
25	7			10 13 17 (30)		D-6		Poorly graded SAND, dense, dark gray, wet, Stratified, HCl reaction not tested, The top 1' was fine sand with some gravel and the bottom .5' was very fine sand with a trace of silt. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8									
30	9			10 11 16 (27)		D-7		Sandy SILT, dense, dark gray, wet, Stratified, HCl reaction not tested, Stratified with silty sand. At 29.7' to 30' we encountered gravels demonstrated by drilling. Length Recovered 1.1 ft, Length Retained 1.1 ft		
	10		>>	29 36 42 (78)		D-8	GS MC	SM, MC=13% Silty SAND, very dense, dark gray, moist, Homogeneous, HCl reaction not tested, With some gravel. Length Recovered 1.4 ft, Length Retained 1.4 ft (GLACIAL TILL)		
35	11									
	12			37 50/6" (50/6")		D-9		Silty SAND with gravel, very dense, dark gray, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft, Length Retained 1.0 ft		
40	13		>>	30 34 44 (78)		D-10		Silty SAND with gravel, very dense, dark gray, moist, Homogeneous, HCl reaction not tested Length Recovered 1.2 ft, Length Retained 1.2 ft		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:32 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-4-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 126.8 ft (38.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
	15			31 50/4" (50/4")		D-11	GS MC	SM, MC=16% Silty SAND, very dense, dark gray, moist. Length Recovered 0.8 ft, Length Retained 0.8 ft		
50								End of test hole boring at 49.3 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Bailed the hole to 43.6'. 30 min. later the water table was at 28.5'. We tripped out the casing and the hole stayed open to 39.3'. The water table was at 6.6'. Coordinates and elevations are from survey. Station and offset are approximate.		
	16									
55										
	17									
	18									
60										
	19									
65										
	20									
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:49:32 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-5-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 125.6 ft (38.3 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fetterly Lic# 2708

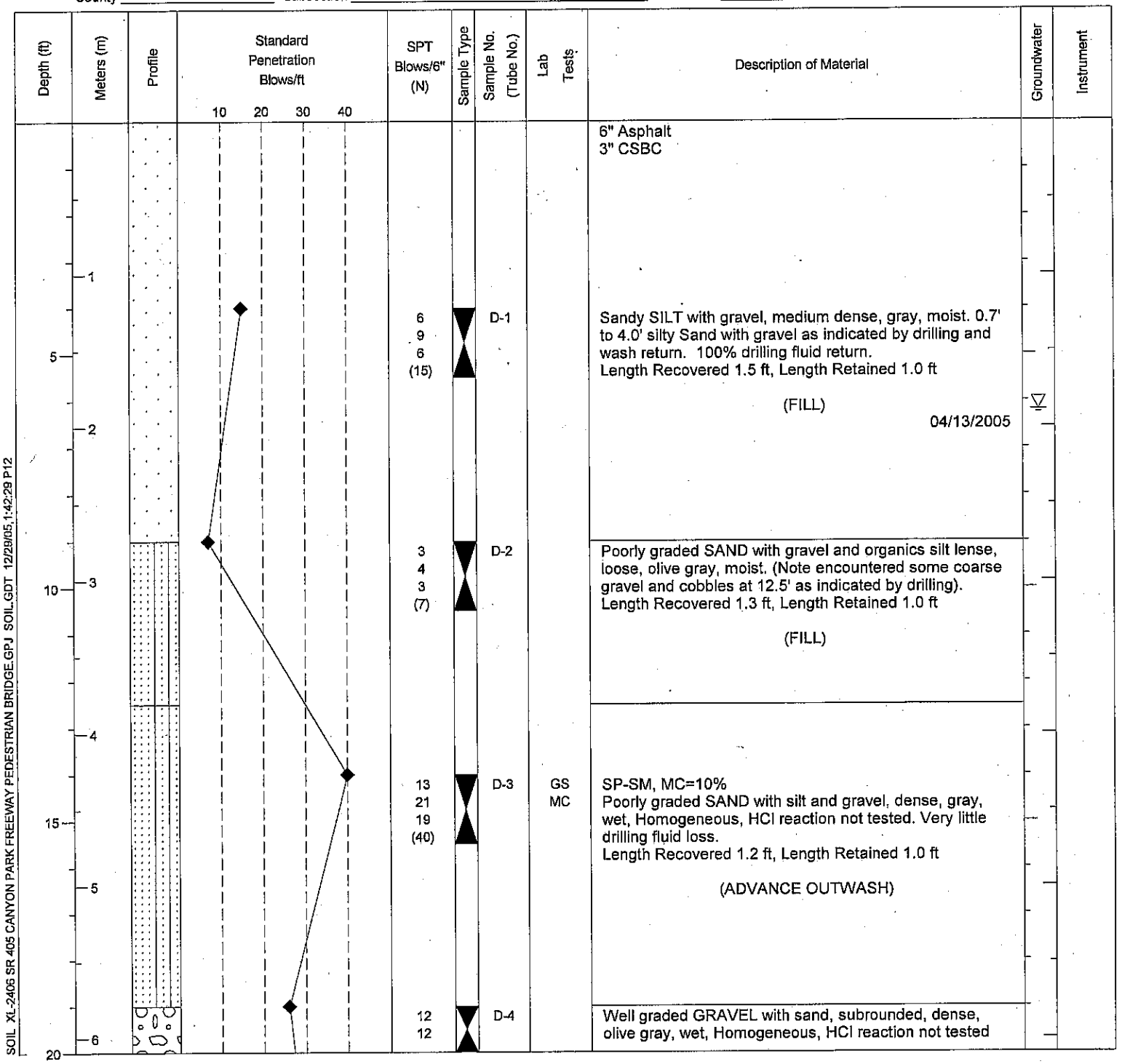
Site Address Vicinity of SR-405 and SR-527 Inspector Cleo Andrews

Start April 13, 2005 Completion April 13, 2005 Well ID# Equipment CME 55 w/ autohammer

Station L 1014+75 Offset 15' LT Casing HQ 3" ID x 55.0' Method Wet Rotary

Northing 620708.914 Easting 1629619.795 Latitude Longitude

County Snohomish Subsection SW 1/4 of the SE 1/4 Section 30 Range 5 EWM Township 27 N



SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05 1:42:29 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-5-05

Sheet 2 of 3

Job No. XL-2406 SR 405 Elevation 125.6 ft (38.3 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				14 (26)				Length Recovered 1.3 ft, Length Retained 1.0 ft (ADVANCE OUTWASH)		
	7									
25				20 16 16 (32)		D-5	GS MC	SM, MC=13% Silty Sand with gravel, laminated with medium grained sand lenses, dense, brown, wet, Stratified, HCl reaction not tested, (Note encountered some coarser gravel at 26.0' as indicated by drilling. Length Recovered 1.5 ft, Length Retained 1.0 ft		
	8									
	9			8 12 16 (28)		D-6		Poorly graded SAND, dense, gray, wet, Homogeneous, HCl reaction not tested Length Recovered 1.5 ft, Length Retained 1.0 ft		
30										
	10									
				8 11 14 (25)		D-7		Sandy SILT with poorly graded sand, dense, gray, moist, Stratified. Length Recovered 1.5 ft, Length Retained 1.3 ft		
35	11									
			>>	39 38 45 (83)		D-8	GS MC	GM, MC=8% Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl reaction not tested Length Recovered 1.2 ft, Length Retained 1.0 ft		
	12									
40										
	13									
				8 13		D-9		Silty SAND with gravel, dense, gray, moist. Length Recovered 1.1 ft, Length Retained 1.0 ft		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:29 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-5-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 125.6 ft (38.3 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			13 (26)						
	15			60/6 (60/6")		D-10		Poorly graded SAND with gravel, very dense, gray, moist, Homogeneous, HCl reaction not tested Length Recovered 0.5 ft, Length Retained 0.5 ft		
50								End of test hole boring at 49.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Water table in casing before bailing hole is 10.0', bailed hole to 17.6', after 10 minutes delay water table at 8.0'. Pulled 10.0' of casing water table stabilized at 6.2', hole stayed open to 25.9'. Ended and abandoned test boring at 49.5' below ground elevation. 4/13/05. Coordinates and elevations are from survey. Station and offset are approximate.		
	16									
55										
	17									
	18									
60										
	19									
65										
	20									
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:29 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-6-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 124.1 ft (37.8 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller Vince Johnson Lic# 2532

Site Address Vic. of SR-405 and SR-527 Inspector Brian Hilts

Start April 19, 2005 Completion April 19, 2005 Well ID# AHN-950 Equipment CME 850 w/ autohammer

Station L 1014+50 Offset 80' RT Casing 6"x20' 4"x57' Method Wet Rotary

Northing 620725.8 Easting 1629305.9 Latitude Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 5 8 (13)		D-1		Poorly graded SAND with gravel, medium dense, grayish brown, moist. Length Recovered 1.2 ft, Length Retained 1.2 ft		
5	1			2 2 4 (6)		D-2		SILT, loose, dark gray, moist. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	2					S-3		No Recovery 04/19/2005	▽	
10	3			4 3 5 (8)		D-4	GS MC	SP-SM, M.C. = 21% Poorly graded SAND with silt, loose, dark gray, wet. From 11' to 12.5' we encountered gravels demonstrated by drilling. Length Recovered 1.1 ft, Length Retained 1.1 ft		
	4									
15	5			4 6 7 (13)		D-5	GS MC	SP-SM, M.C. = 25% Poorly graded SAND with silt, medium dense, dark gray, wet. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	6			8 12		D-6	GS MC	ML, M.C. = 24% SILT with sand, medium dense, dark gray, wet.		
20										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:30 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-6-05

Sheet 2 of 3

Job No. XL-2406 SR 405 Elevation 124.1 ft (37.8 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				12 (24)				Length Recovered 0.5 ft, Length Retained 0.5 ft		
	7									
25				12 15 16 (31)		D-7		Silty SAND, dense, dark gray, wet. At 27' we encountered gravels demonstrated by drilling. Length Recovered 0.6 ft, Length Retained 0.6 ft (GLACIAL TILL)		
	8									
	9			13 23 25 (48)		D-8		Silty SAND with gravel, dense, dark gray, wet. From 25.5 to 29' we encountered scattered gravels demonstrated by drilling. Length Recovered 0.8 ft, Length Retained 0.8 ft		
30										
	10									
			>>	20 34 50/4" (84/4")		D-9		Silty SAND, very dense, dark gray, wet. Length Recovered 1.2 ft, Length Retained 1.2 ft		
35	11									
			>>	70/6" (70/6")		D-10		Poorly graded GRAVEL with sand, angular, very dense, dark gray, wet. Length Recovered 0.5 ft, Length Retained 0.5 ft (ADVANCE OUTWASH)		
40	12									
	13									
			>>	52/6" (52/6")		D-11		Poorly graded SAND, very dense, dark gray, wet. With a few scattered gravels throughout the run.		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:30 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-6-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 124.1 ft (37.8 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14							Length Recovered 0.5 ft, Length Retained 0.5 ft		
50	15		>>	80/6" (80/6")		D-12		Sandy SILT, very dense, dark gray, wet. Length Recovered 0.4 ft, Length Retained 0.4 ft		
	16		>>	65/6" (65/6")		D-13		Poorly graded SAND, very dense, dark gray, wet. Length Recovered 0.5 ft, Length Retained 0.5 ft		
55	17							End of test hole boring at 54.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	18							The water table inside the casing after drilling was at 8'. Bailed the hole, and after the install, the water table was at 6.6'. I then bailed the piezometer with no progress, so the water table stabilized at 6.6'.		
60	19							Coordinates and elevations are from survey. Station and offset are approximate.		
65	20									
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:30 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-7-05

Sheet 1 of 3

Job No. XL-2406 SR 405 Elevation 124.8 ft (38.0 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fetterly Lic# 2708

Site Address Vic. of SR-405 and SR-527 Inspector Vince Johnson

Start April 11, 2005 Completion April 11, 2005 Well ID# Equipment CME 55 w/ autohammer

Station AR4 94+65 Offset 40' RT Casing 4'x57' Method Wet Rotary

Northing 620752.9 Easting 1629229 Latitude Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				2 9 13 9 (22)		D-1		Silty SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 2.0 ft (FILL)		
5	1			3 3 10 (13)		D-2		Silty SAND, medium dense, brown, wet. With a trace of organics. Drilling fluid color change at 9' from gray to brown. Length Recovered 1.5 ft, Length Retained 1.0 ft		
10	2 3			6 6 8 (14)		D-3		04/11/05 Silty SAND, medium dense, reddish brown, wet. At 12' we encountered gravels demonstrated by drilling. Length Recovered 1.5 ft, Length Retained 1.0 ft	▽	
15	4 5			4 5 7 (12)		D-4	GS MC	SM, M.C. = 23% Silty SAND, medium dense, gray, wet. Length Recovered 1.0 ft, Length Retained 1.0 ft (FILL)		
20	6			10 12		D-5		Silty SAND, medium dense, gray, wet. Length Recovered 1.1 ft, Length Retained 1.1 ft		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:30 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-7-05

Sheet 2 of 3

Job No. XL-2406 SR 405 Elevation 124.8 ft (38.0 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				12 (24)						
	7									
25				11 13 17 (30)		D-6		Silty SAND with gravel, dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.2 ft, Length Retained 1.0 ft (GLACIAL TILL)		
	8									
	9			17 20 25 (45)		D-7		Silty SAND with gravel, dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft, Length Retained 1.0 ft		
30								(ADVANCE OUTWASH)		
	10									
			>>	20 41 50/4" (91)		D-8		Well graded SAND with gravel, very dense, gray, moist. Length Recovered 1.4 ft, Length Retained 1.4 ft		
35	11									
	12		>>	20 27 47 (74)		D-9		Poorly graded SAND, very dense, gray, wet. Length Recovered 1.5 ft, Length Retained 1.5 ft		
40										
	13									
			>>	60/6" (60/6")		D-10		Poorly graded SAND, very dense, gray, moist. With a trace of gravel.		
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-7-05

Sheet 3 of 3

Job No. XL-2406 SR 405 Elevation 124.8 ft (38.0 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14							Length Recovered 0.5 ft, Length Retained 0.5 ft		
	15		>>	7 20 50 (70)		D-11		Well graded SAND with gravel, dense, gray, wet. Length Recovered 1.5 ft, Length Retained 1.5 ft		
50	16		>>	80/6" (80/6")		D-12		SILT, very dense, gray, moist, With a trace of gravel. Length Recovered 0.5 ft, Length Retained 0.5 ft		
55	17							End of test hole boring at 54.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Coordinates and elevations are from survey. Station and offset are approximate.		
	18									
60	19									
65	20									
	21									
70										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-8-05

Sheet 1 of 2

Job No. XL-2406 SR 405 Elevation 127.4 ft (38.8 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fettely Lic# 2708

Site Address Vicinity of SR-405 and SR-527 Inspector Cleo Andrews

Start April 12, 2005 Completion April 12, 2005 Well ID# AHN-951 Equipment CME 55 w/ autohammer

Station L 1016+95 Offset 90' RT Casing HWT 4" & HQ 3" Method Wet Rotary

Northing 620927.476 Easting 1629510.086 Latitude Longitude

County Snohomish Subsection SW 1/4 of the SE 1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 4 5 (9)		D-1	pH Res	Silty SAND with gravel, with root hairs, loose, brown, moist. Length Recovered 1.5 ft, Length Retained 1.0 ft (Fill material)		
	1			4 4 6 (8)		D-2		Silty SAND with gravel, loose, gray, moist. Length Recovered 1.0 ft, Length Retained 1.0 ft 04/12/2005	▽	
5	2									
				1 2 1 (3)		D-3	GS MC	SP-SM, M.C. = 22% Poorly graded SAND with silt, with decayed wood fragments, very loose, gray, wet. Length Recovered 1.0 ft, Length Retained 1.0 ft		
10	3									
	4									
				2 2 2 (4)		D-4	GS MC	SP-SM, M.C. = 15% Poorly graded SAND with silt and gravel, with sandy silt lens, very loose, olive gray, wet. Length Recovered 1.0 ft, Length Retained 1.0 ft		
15	5									
				2 1		D-5		Poorly graded SAND with gravel, with organic silt and decayed wood debris, very loose, gray, wet.		
20	6									

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65949

HOLE No. H-8-05

Sheet 2 of 2

Job No. XL-2406 SR 405 Elevation 127.4 ft (38.8 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fettely Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 (2)				Length Recovered 1.5 ft, Length Retained 1.0 ft		
	7									
25				5 12 16 (28)		D-6	GS MC	SP, M.C. = 10% Poorly graded SAND with gravel, subrounded, dense, gray, wet. Length Recovered 1.2 ft, Length Retained 1.0 ft		
	8									
								End of test hole boring at 25.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	9							Coordinates and elevations are from survey. Station and offset are approximate.		
30										
	10									
35										
	11									
	12									
40										
	13									
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:31 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-9-05

Sheet 1 of 2

Job No. XL-2406 SR 405 Elevation 127.1 ft (38.7 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fetterly Lic# 2708

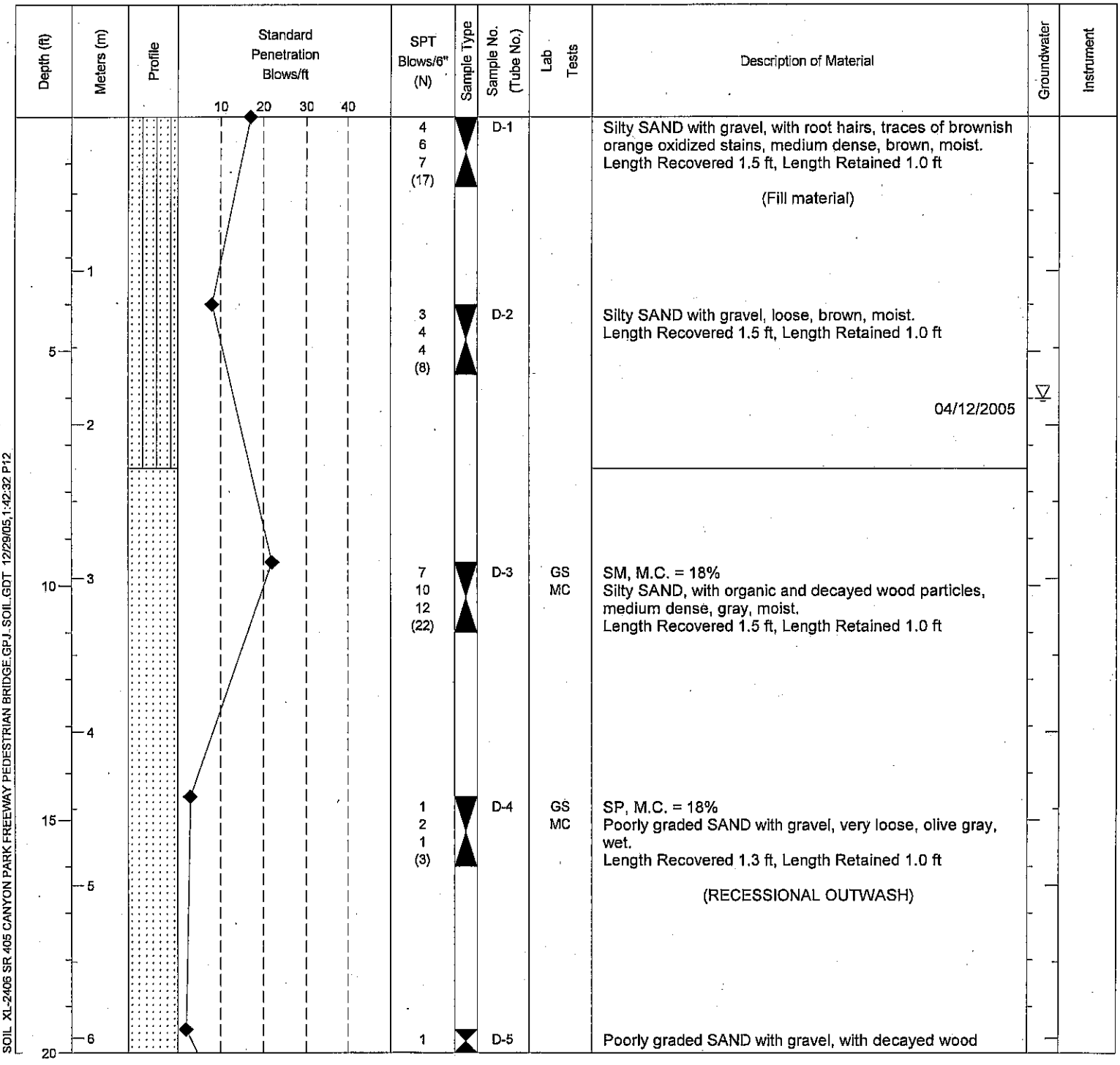
Site Address Vicinity of SR-405 and SR-527 Inspector Cleo Andrews

Start April 12, 2005 Completion April 12, 2005 Well ID# Equipment CME 55 w/ autohammer

Station BR4 17+90 Offset 40' LT Casing HQ 3" ID x 30.0' Method Wet Rotary

Northing Easting Latitude Longitude

County Snohomish Subsection SW 1/4 of the SE 1/4 Section 30 Range 5 EWM Township 27 N



SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ..SOIL.GDT 12/29/05,1:42:32 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-9-05

Sheet 2 of 2

Job No. XL-2406 SR 405 Elevation 127.1 ft (38.7 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 1 (2)				particles, very loose, olive gray, wet, (some coarser gravel indicated by drilling at 20.0'). Length Recovered 1.0 ft, Length Retained 1.0 ft		
	7									
25				5 12 16 (28)		D-6		Poorly graded SAND with gravel, dense, brown, wet, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft, Length Retained 1.0 ft		
	8							End of test hole boring at 26 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Water table in hole before bailing is 6.0'. Pulled 10.0' of casing water table stabilized at 6.0' after 10 minutes delay. Ended and abandoned test boring at 26.0' below ground elevation. 4/12/05. Coordinates and elevations are from survey. Station and offset are approximate.		
	9									
30										
	10									
35										
	11									
	12									
40										
	13									
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:32 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-10-05

Sheet 1 of 2

Job No. XL-2406 SR 405 Elevation 162.9 ft (49.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fetterly Lic# 2708

Site Address Vicinity of SR-405 and SR-527 Inspector Cleo Andrews

Start April 13, 2005 Completion April 13, 2005 Well ID# Equipment CME 55 w/ autohammer

Station 2J 661+90 Offset 20' LT Casing HQ 3" ID x 30.0' Method Wet Rotary

Northing 620744.3 Easting 1629061.8 Latitude Longitude

County Snohomish Subsection SW 1/4 of the SE 1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 11 10 (21)		D-1		Well graded GRAVEL with sand, subrounded, medium dense, brown, moist. Length Recovered 1.0 ft, Length Retained 1.0 ft (FILL)		
5	1			5 7 9 (16)		D-2		Silty SAND with gravel, medium dense, brown, moist. Length Recovered 1.3 ft, Length Retained 1.0 ft		
10	2 3			10 11 12 (23)		D-3		Silty SAND, medium dense, brown, moist. Length Recovered 1.0 ft, Length Retained 1.0 ft		
15	4 5			7 11 15 (26)		D-4		Poorly graded SAND, dense, brown, moist. Length Recovered 1.3 ft, Length Retained 1.0 ft (RECESSIONAL OUTWASH)	▽ 04/13/2005	
20	6			5		D-5		Sandy SILT, with horizontal thin brown seams, medium		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05 1:42:25 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-10-05

Sheet 2 of 2

Job No. XL-2406 SR 405 Elevation 162.9 ft (49.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 6 (11)				dense, brown, moist. Length Recovered 1.5 ft, Length Retained 1.3 ft		
25	7			4 5 6 (11)		D-6		Sandy SILT, medium dense, olive gray, moist, traces of brownish orange oxidized stains. Length Recovered 1.5 ft, Length Retained 1.3 ft		
	8							End of test hole boring at 26 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Coordinates and elevations are from survey. Station and offset are approximate.		
30	9									
	10									
35	11									
	12									
40	13									
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:25 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-11-05

Sheet 1 of 1

Job No. XL-2406 SR 405 Elevation 123.3 ft (37.6 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller Vince Johnson Lic# 2532

Site Address Vic. of SR-405 and SR-527

Inspector Brian Hilts

Start April 20, 2005 Completion April 20, 2005 Well ID#

Equipment CME 850 w/ autohammer

Station AR4 96+30 Offset 55' LT Casing 9"x20.5'

Method Wet Rotary

Northing 620903.381 Easting 1629596.643 Latitude

Longitude

County Snohomish Subsection SW1/4 SE1/4 Section 30 Range 5 EWM Township 27 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								04/20/2005	▽	
				2 2 1 (3)		D-1	GS MC	SM, M.C. = 14% Silty SAND with gravel, very loose, grayish brown, wet. The top .3' was well grade coarse sand with gravel, and the bottom .3' was silty fine sand gray in color. Length Recovered 0.6 ft, Length Retained 0.6 ft (FILL)		
				11 13 13 11 (26)		D-2		Poorly graded SAND with gravel, dense, dark gray, wet. Length Recovered 2.0 ft, Length Retained 2.0 ft		
				2 1 3 7 (4)		D-3	GS MC	SP-SM, M.C. = 20% Poorly graded SAND with silt and gravel, very loose, dark gray, wet, with a trace of dark brown organics. Length Recovered 1.7 ft, Length Retained 1.7 ft		
				9 12 15 15 (27)		D-4		Poorly graded SAND with gravel, dense, dark gray, wet, with a trace of dark brown organics. Length Recovered 1.6 ft, Length Retained 1.6 ft		
								End of test hole boring at 16.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Coordinates and elevations are from survey. Station and offset are approximate.		

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:26 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-12-05

Sheet 1 of 2

Job No XL-2406 SR 405 Elevation 124.9 ft (38.1 m)

Project Canyon Park Freeway Station Pedestrian Bridge Driller James Fetterly Lic# 2708

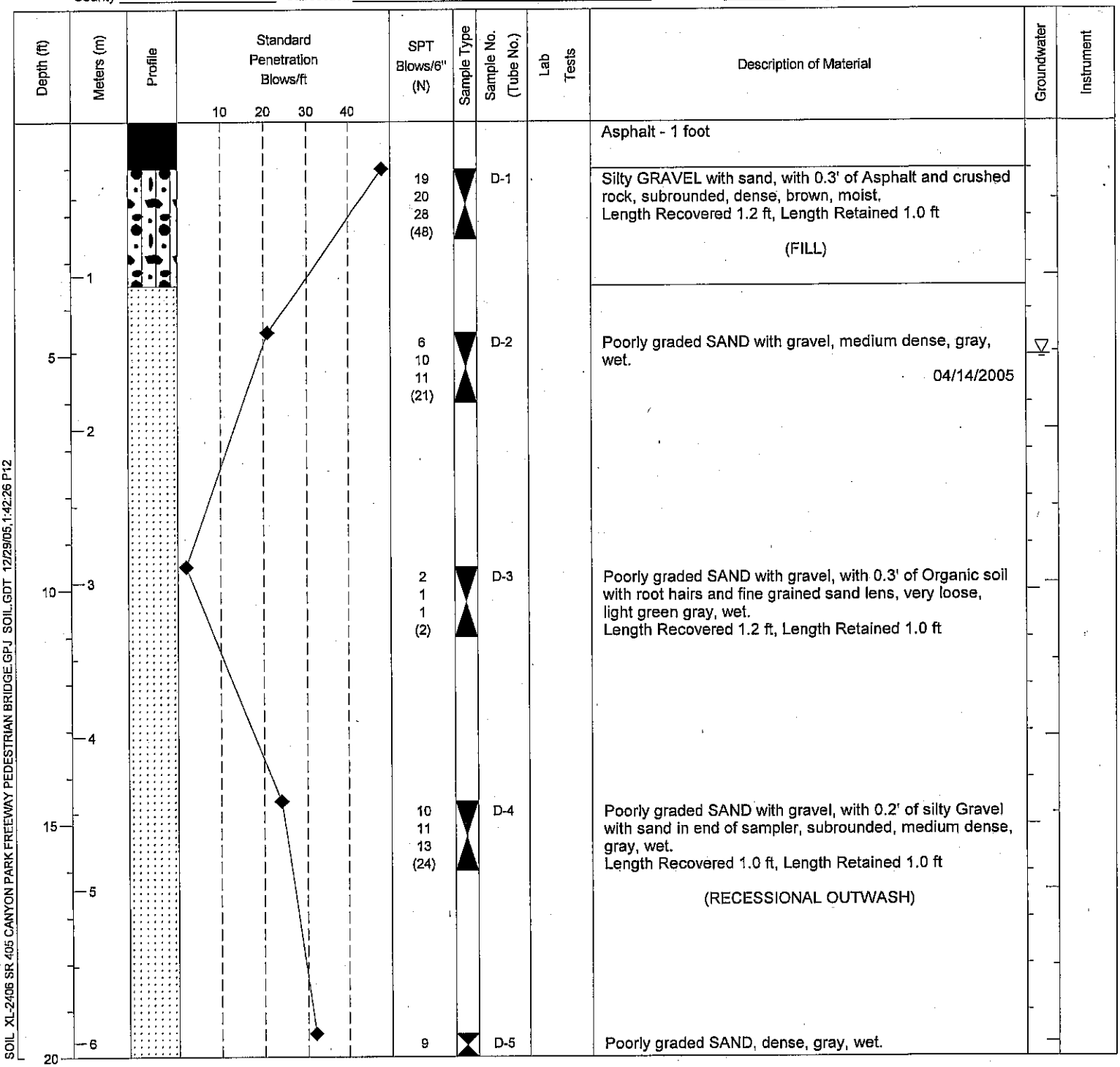
Site Address Vicinity of SR-405 and SR-527 Inspector Cleo Andrews

Start April 14, 2005 Completion April 14, 2005 Well ID# Equipment CME 55 w/ autohammer

Station AL4 95+05 Offset 40' LT Casing HQ 3" ID x 25.0' Method Wet Rotary

Northing 620579.9 Easting 1629527.9 Latitude Longitude

County Snohomish Subsection SW 1/4 of the SE 1/4 Section 30 Range 5 EWM Township 27 N



SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:26 P12

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22759

HOLE No. H-12-05

Sheet 2 of 2

Job No. XL-2406 SR 405 Elevation 124.9 ft (38.1 m)

Project Canyon Park Freeway Station Pedestrian Bridge

Driller James Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				14 18 (32)				Length Recovered 1.5 ft, Length Retained 1.0 ft		
								End of test hole boring at 21 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Water table is at 5,0' below ground level. Ended and abandon test boring at 21.0' below ground elevation.. 4/14/05. Coordinates and elevations are from survey. Station and offset are approximate.		
25	7									
	8									
30	9									
	10									
35	11									
	12									
40	13									
45										

SOIL XL-2406 SR 405 CANYON PARK FREEWAY PEDESTRIAN BRIDGE.GPJ SOIL.GDT 12/29/05,1:42:26 P12

APPENDIX C - LABORATORY TESTING

LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. Testing included performing moisture content, grain size analyses, resistivity and pH. The tests were done in general accordance with AASHTO T-88, T-89, T-288 and T-289 guide specifications, respectively. After the testing was complete, the samples were classified in general accordance with the Unified Soil Classification System (USCS).

Job No. **XL-2406** Date **May 23, 2005**

Hole No. **H-1-05** Sheet **1** of **2**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

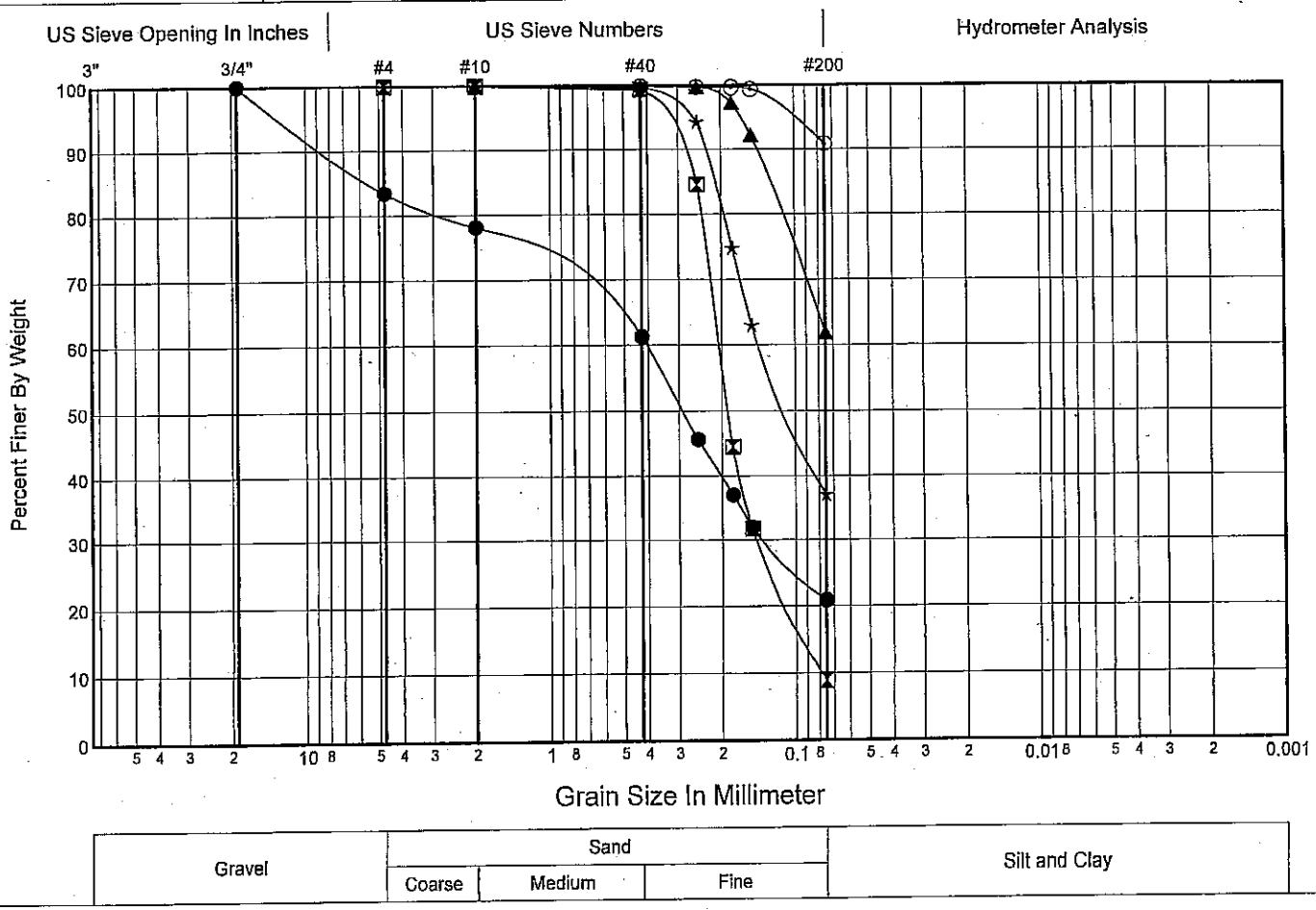
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	SM	See Boring Log	SILTY SAND with GRAVEL	9			
⊠	14.0	4.27	D-4	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	28			
▲	19.0	5.79	D-5	ML	See Boring Log	SANDY SILT	28			
★	24.0	7.32	D-6	SM	See Boring Log	SILTY SAND	27			
⊙	34.0	10.36	D-8	ML	See Boring Log	SILT	28	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	16.6	62.6	20.8		
⊠	0.0	91.1	8.9	1.3	2.6
▲	0.0	38.2	61.8		
★	0.0	62.9	37.1		
⊙	0.0	9.2	90.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.407	0.29	0.13		
⊠	0.204	0.19	0.14	0.11	0.078
▲					
★	0.139	0.11			
⊙					



Job No. **XL-2406** Date **May 23, 2005**

Hole No. **H-1-05** Sheet **2** of **2**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

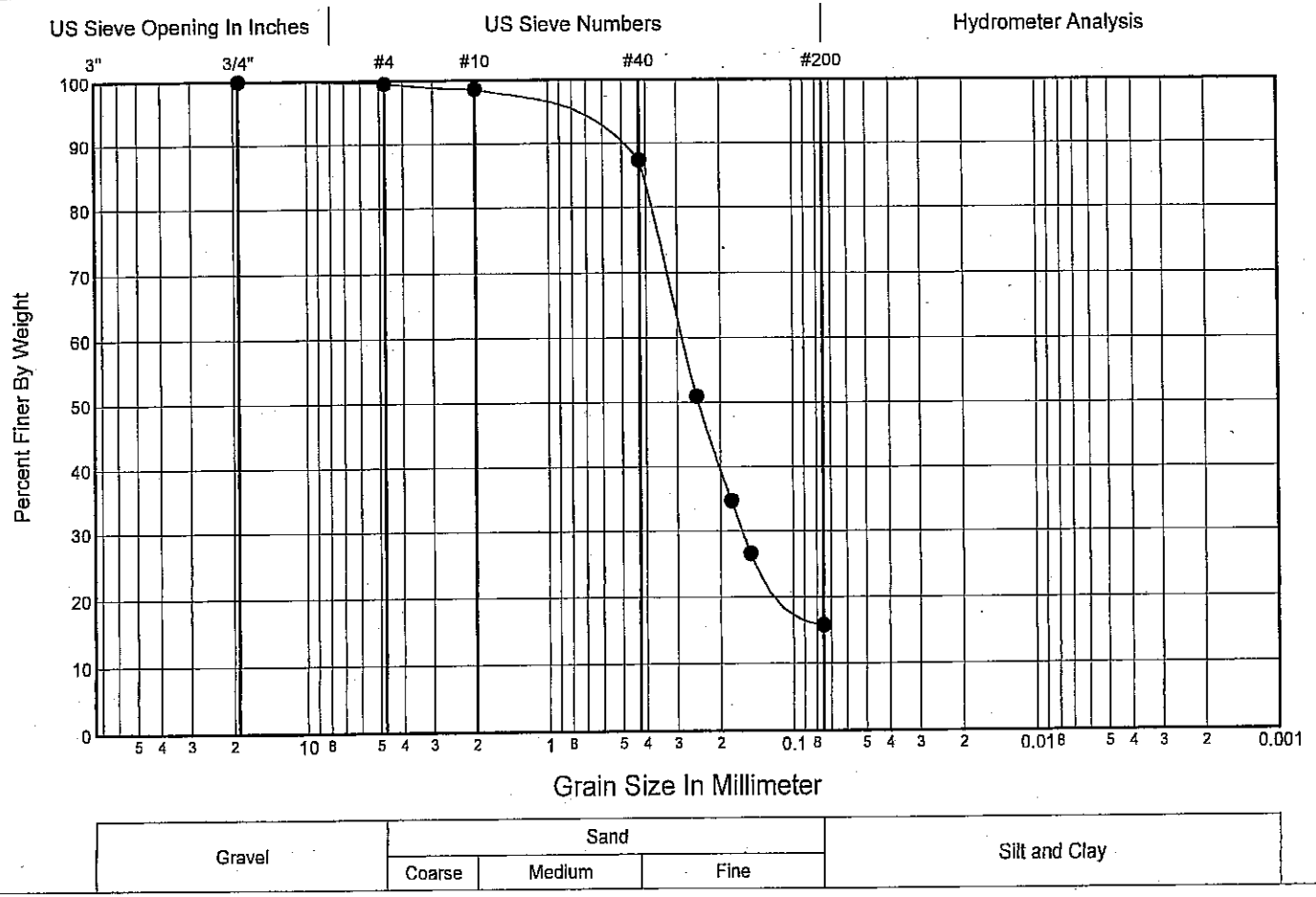
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	44.0	13.41	D-10	SM	See Boring Log	SILTY SAND	19			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.5	83.8	15.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.285	0.25	0.16	0.10	



Job No. **XL-2406** Date **May 18, 2005**

Hole No. **H-2-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

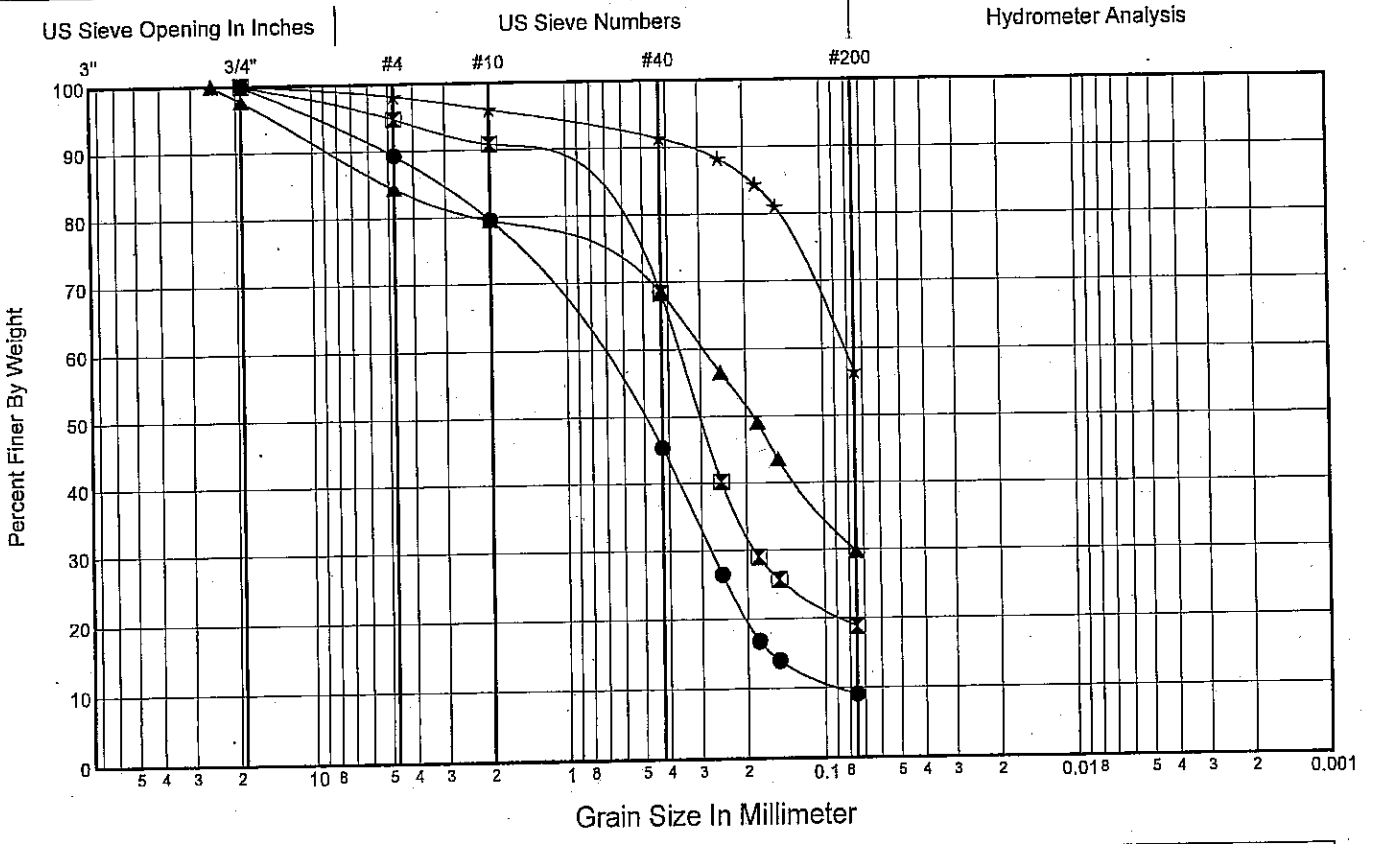
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-3	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	17			
⊠	19.0	5.79	D-5	SM	See Boring Log	SILTY SAND	22			
▲	39.0	11.89	D-9	SM	See Boring Log	SILTY SAND with GRAVEL	12			
★	54.0	16.46	D-12	ML	See Boring Log	SANDY SILT	19			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	10.7	80.3	9.0	1.1	9.6
⊠	5.2	76.0	18.8		
▲	15.7	54.6	29.7		
★	1.8	41.7	56.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.826	0.53	0.28	0.20	0.086
⊠	0.363	0.30	0.19	0.09	
▲	0.292	0.19	0.08		
★	0.083				



Job No. **XL-2406** Date **May 12, 2005**

Hole No. **H-3-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

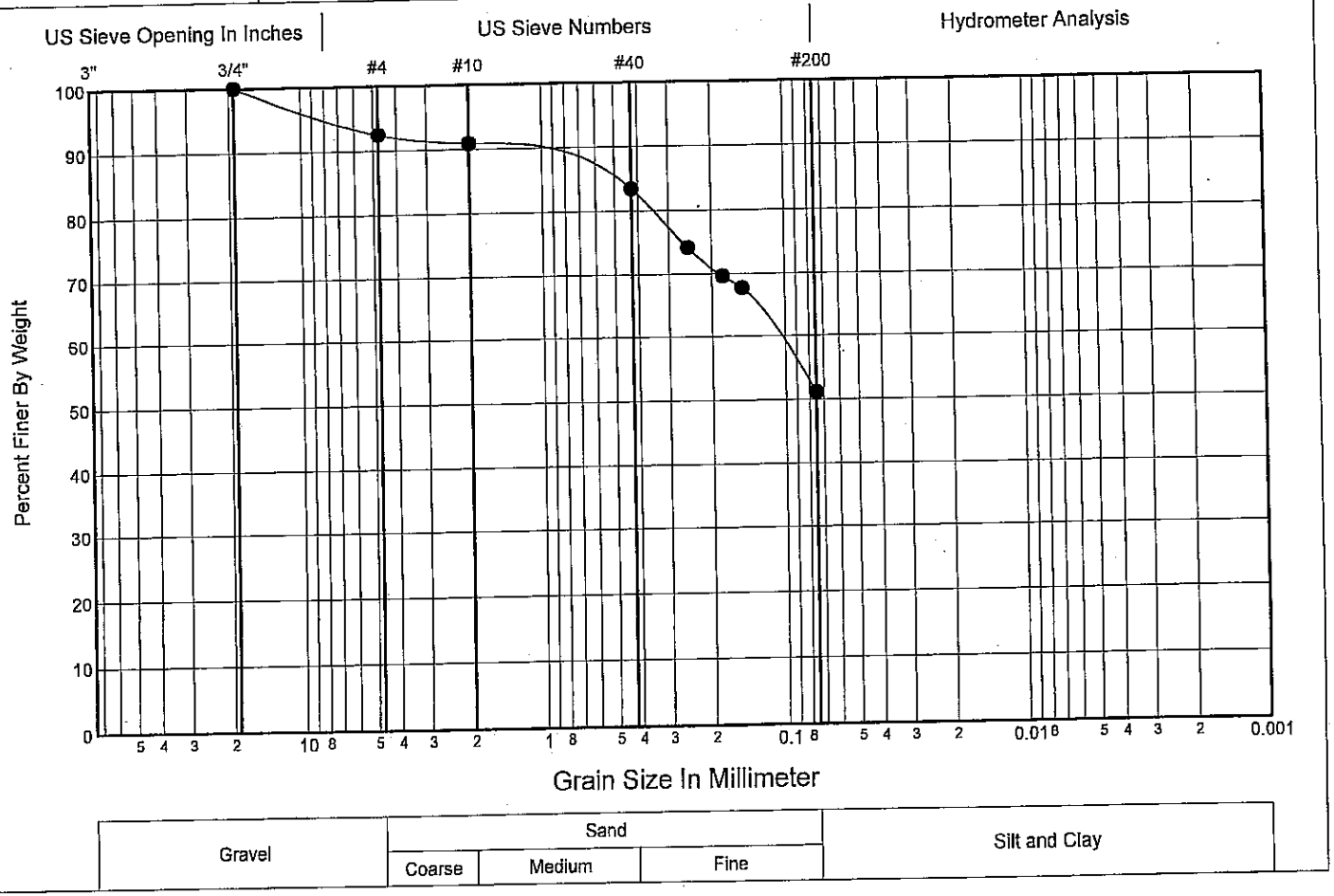
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	28.5	8.69	D-7	ML	See Boring Log	SANDY SILT	21			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	7.6	41.3	51.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.109				



Job No. **XL-2406** Date **May 10, 2005**

Hole No. **H-4-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

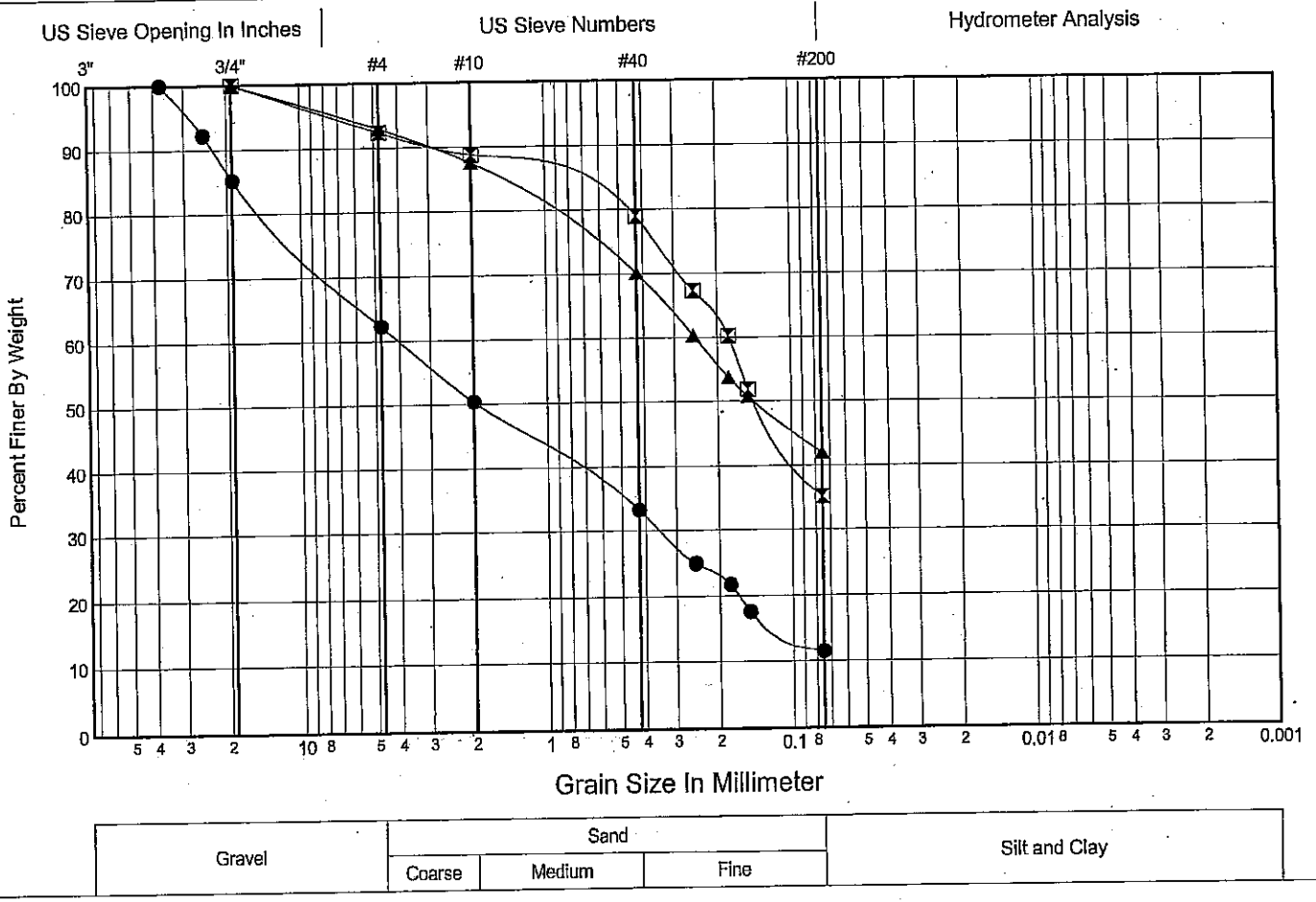
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	13.5	4.11	D-4	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	11			
⊠	33.5	10.21	D-8	SM	See Boring Log	SILTY SAND	13			
▲	48.5	14.78	D-11	SM	See Boring Log	SILTY SAND	16			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	37.7	50.8	11.4	0.5	63.6
⊠	7.7	57.2	35.1		
▲	7.1	51.0	41.9		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	4.033	1.94	0.35	0.17	
⊠	0.179	0.14			
▲	0.246	0.14			



Job No. XL-2406 Date May 10, 2005

Hole No. H-5-05 Sheet 1 of 1

Project Canyon Park Freeway Station Pedestrian Bridge

Laboratory Summary

Washington State Department of Transportation

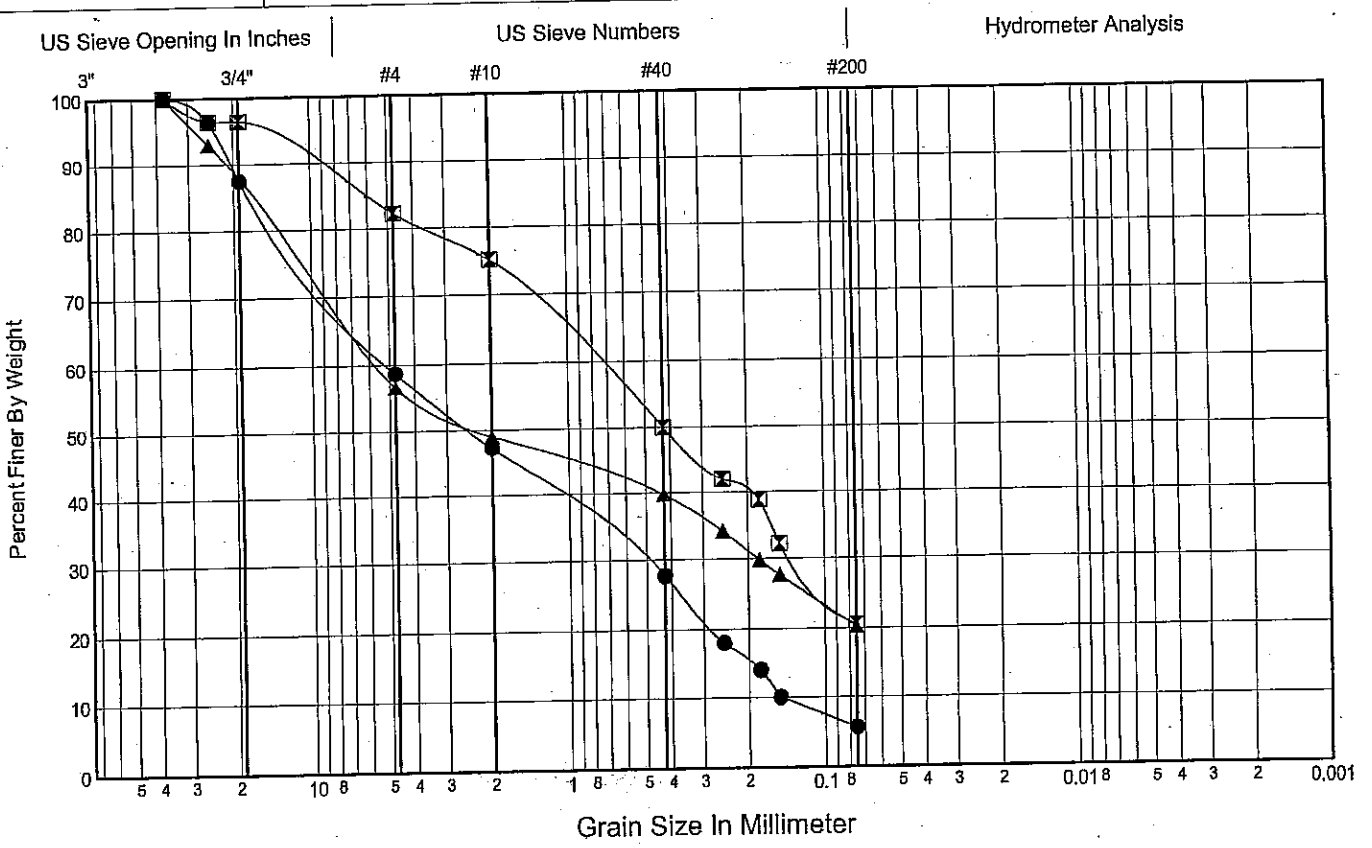
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	14.0	4.27	D-3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	10			
⊠	24.0	7.32	D-5	SM	See Boring Log	SILTY SAND with GRAVEL	13			
▲	39.0	11.89	D-8	GM	See Boring Log	SILTY GRAVEL with SAND	8			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	41.4	53.0	5.7	0.3	34.0
⊠	17.7	61.8	20.4		
▲	43.5	36.4	20.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	5.074	2.47	0.51	0.28	0.149
⊠	0.788	0.43	0.13		
▲	5.538	2.25	0.18		



Job No. **XL-2406** Date **May 24, 2005**

Hole No. **H-6-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

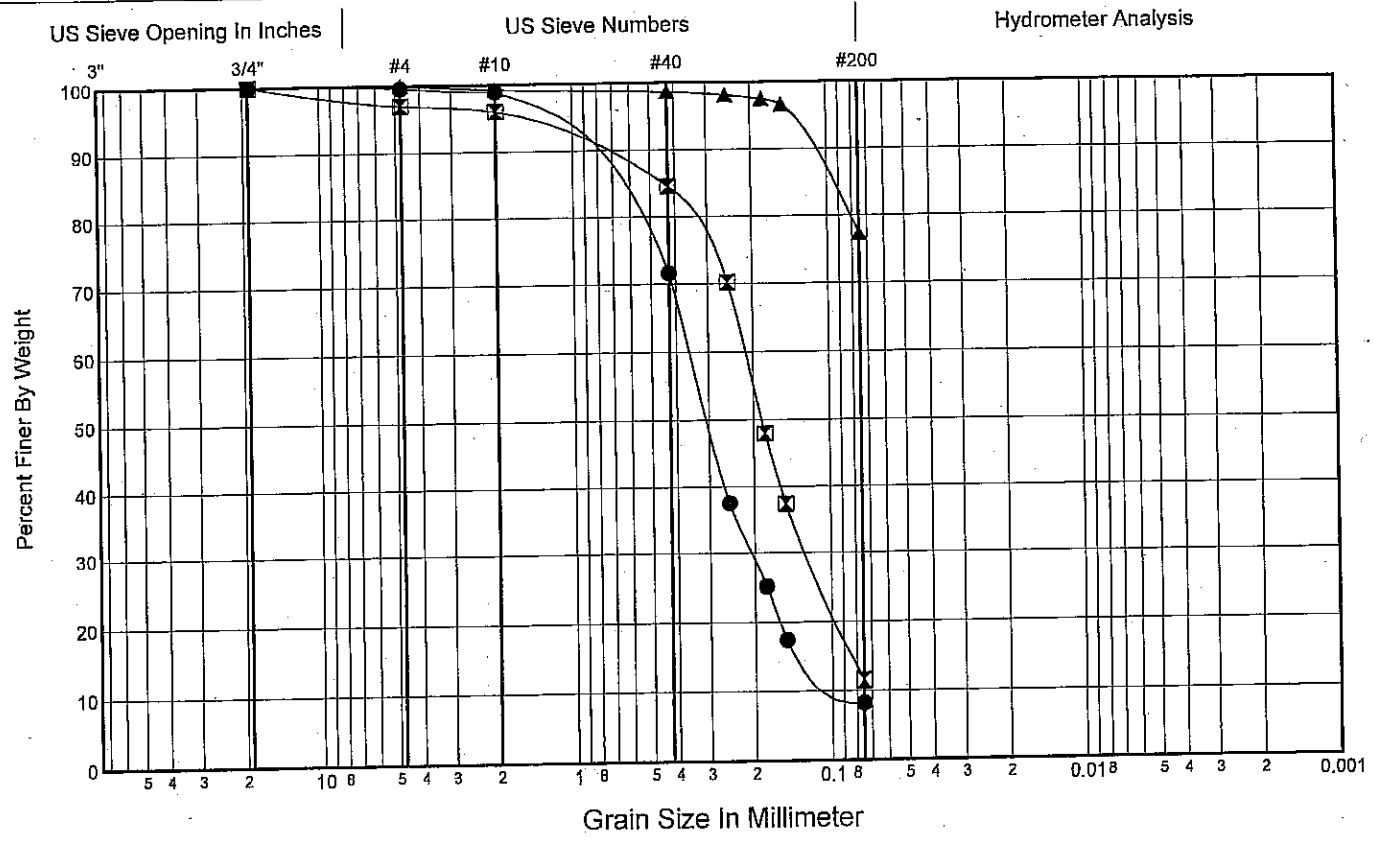
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-4	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	21			
⊠	14.0	4.27	D-5	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	25			
▲	19.0	5.79	D-6	ML	See Boring Log	SILT with SAND	24			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.4	91.4	8.2	1.4	4.1
⊠	3.0	85.5	11.5	1.0	3.0
▲	0.0	22.8	77.2		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.355	0.30	0.20	0.16	0.086
⊠	0.215	0.19	0.12	0.09	
▲					



Job No. **XL-2406** Date **May 18, 2005**

Hole No. **H-7-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

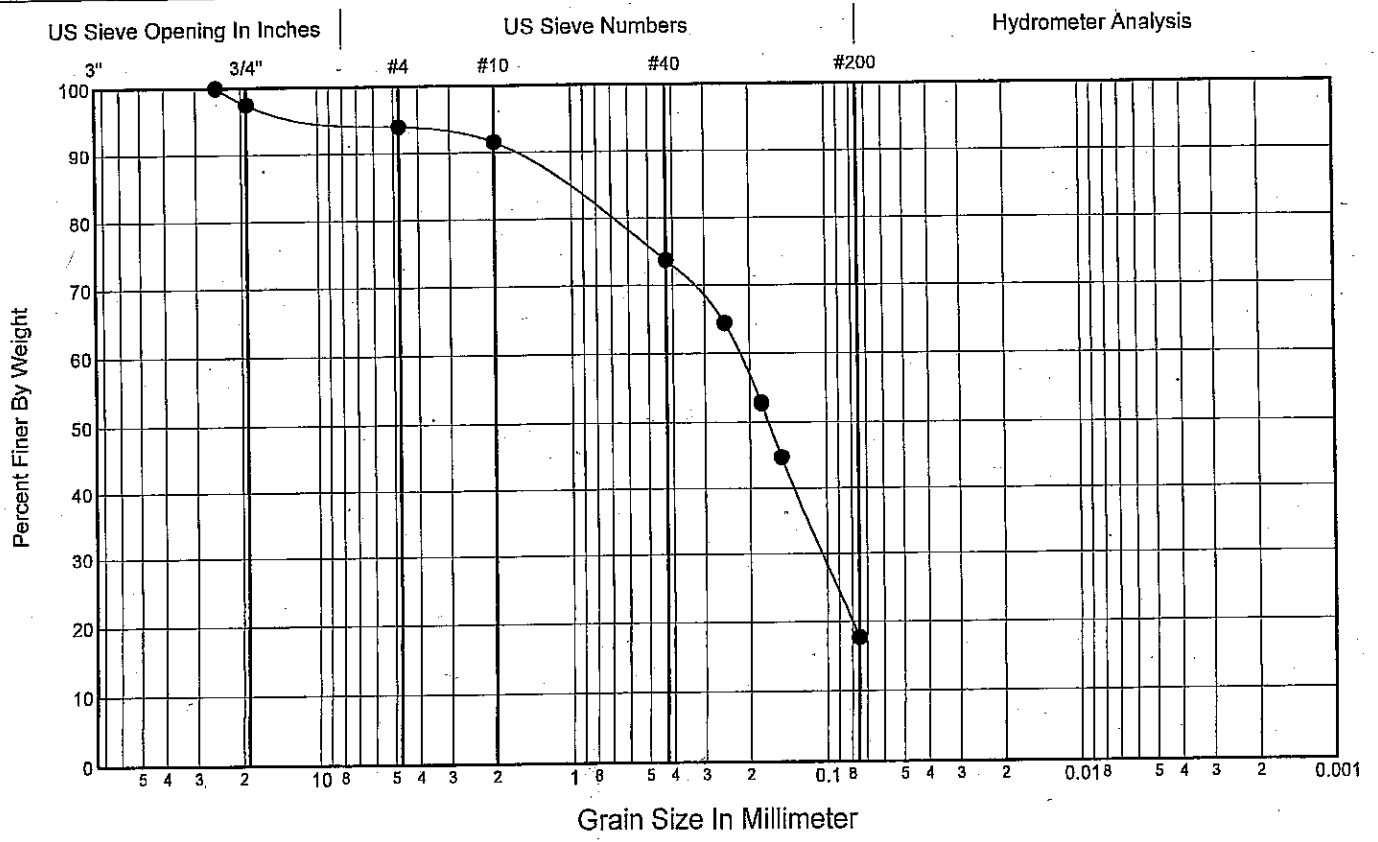
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	14.0	4.27	D-4	SM	See Boring Log	SILTY SAND	23			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	6.0	76.2	17.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.221	0.17	0.10	0.08	



Job No. **XL-2406** Date **May 18, 2005**

Hole No. **H-8-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

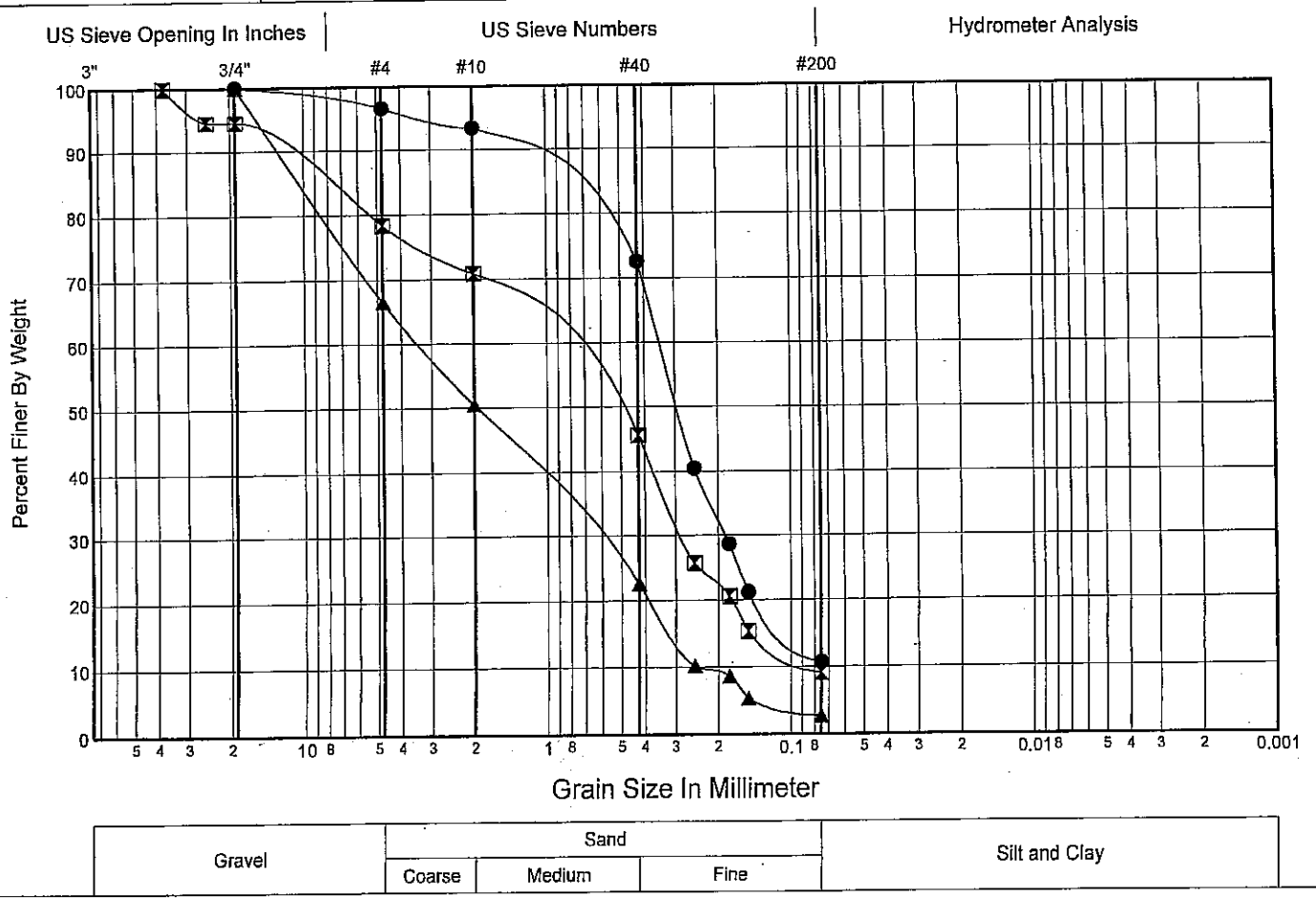
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT with wood fragments	22			
⊠	14.0	4.27	D-4	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	15			
▲	24.0	7.32	D-6	SP	See Boring Log	POORLY GRADED SAND with GRAVEL	10			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.4	86.0	10.6	1.4	4.8
⊠	21.6	69.3	9.0	0.9	12.3
▲	33.6	63.7	2.8	0.5	13.8

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.345	0.29	0.19	0.14	
⊠	1.028	0.56	0.28	0.18	0.083
▲	3.356	1.95	0.65	0.38	0.242



Job No. **XL-2406** Date **May 24, 2005**

Hole No. **H-9-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

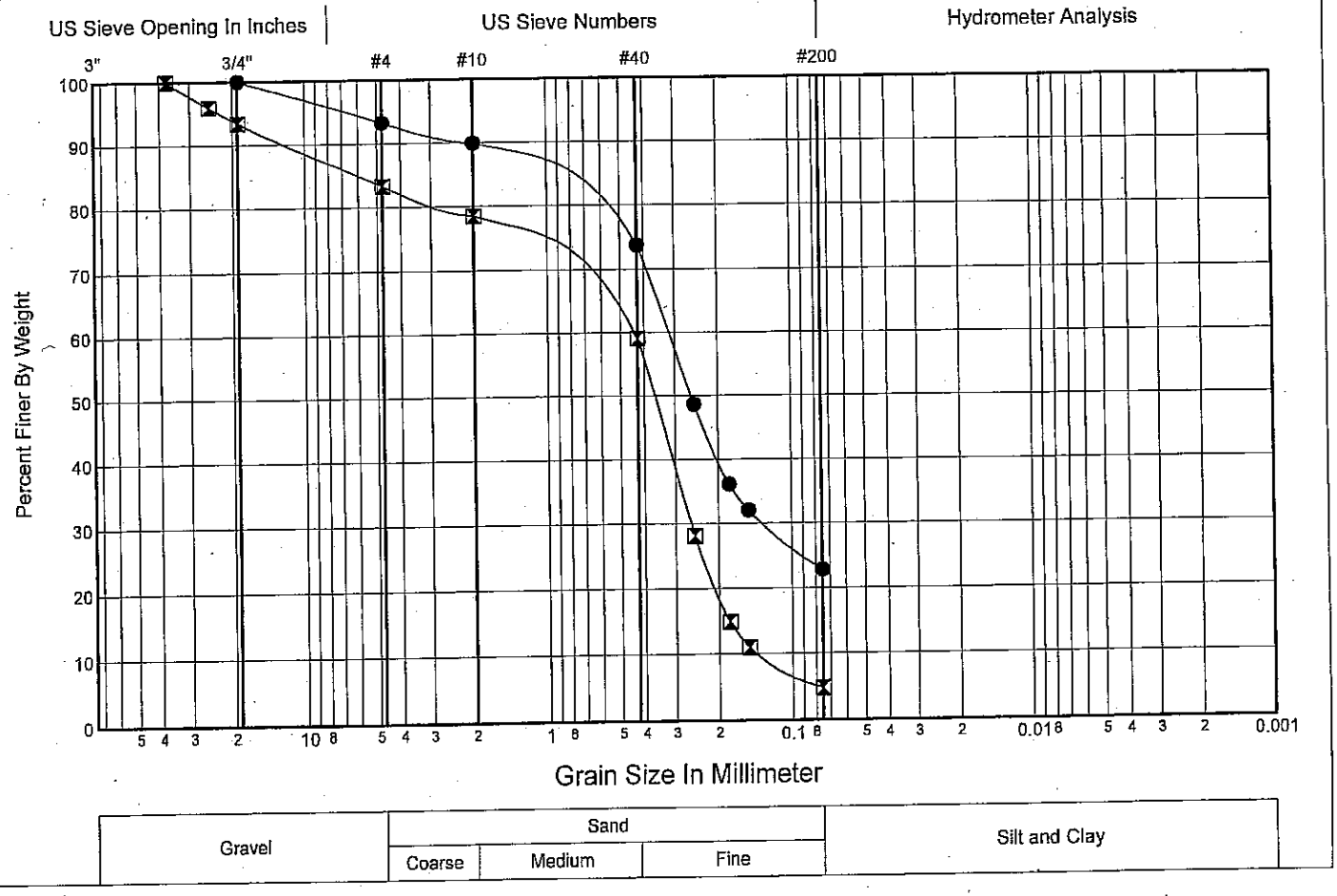
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.5	2.90	D-3	SM	See Boring Log	SILTY SAND	18			-
⊠	14.5	4.42	D-4	SP	See Boring Log	POORLY GRADED SAND with GRAVEL	18			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	6.7	70.5	22.7		
⊠	16.8	78.5	4.8	1.1	3.4

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.318	0.26	0.13		
⊠	0.458	0.36	0.26	0.20	0.135



Job No. **XL-2406** Date **May 18, 2005**

Hole No. **H-11-05** Sheet **1** of **1**

Project **Canyon Park Freeway Station Pedestrian Bridge**

Laboratory Summary

Washington State Department of Transportation

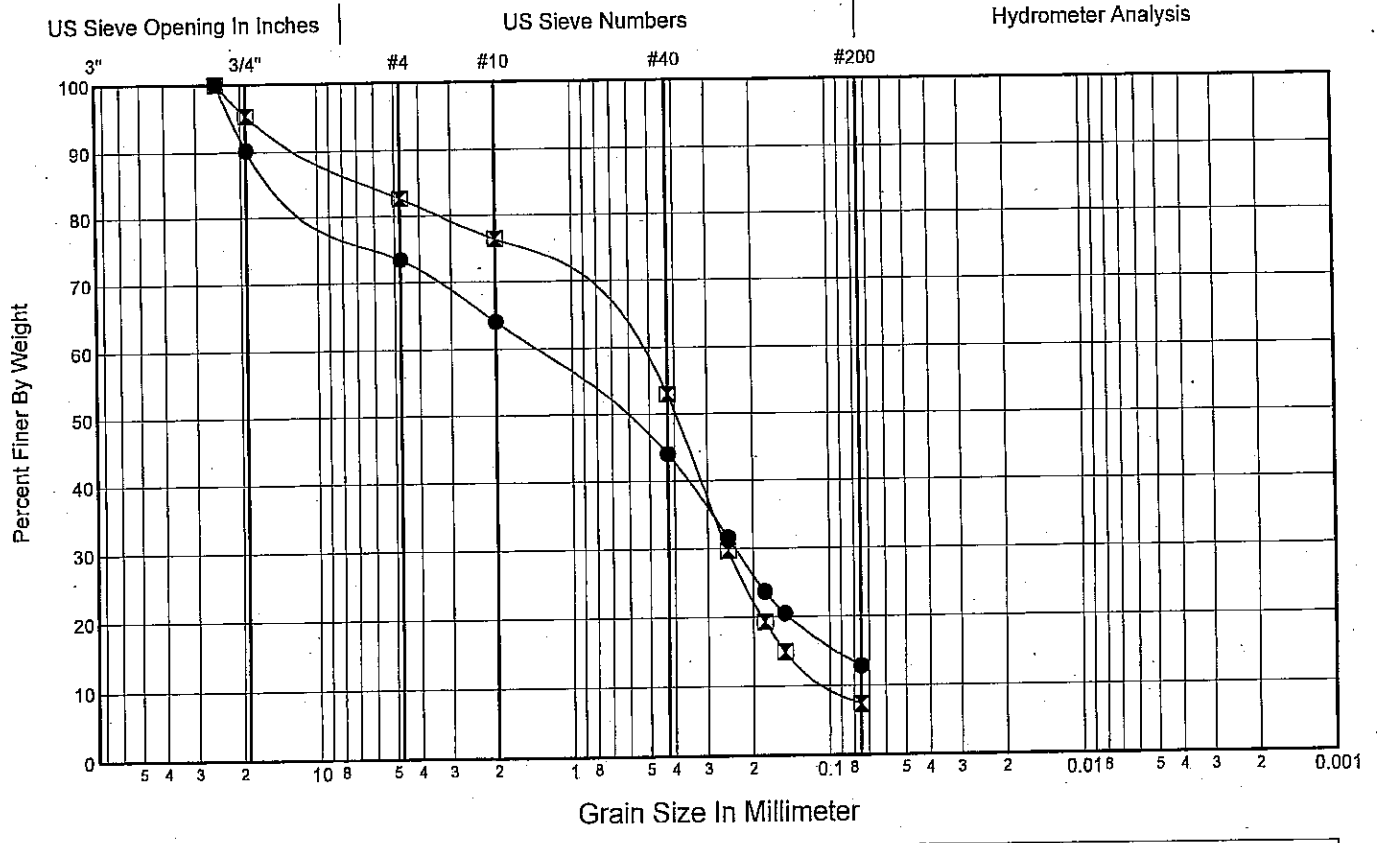
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	2.5	0.76	D-1	SM	See Boring Log	SILTY SAND with GRAVEL	14			
⊠	12.5	3.81	D3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	20			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	26.6	60.6	12.8		
⊠	17.4	75.4	7.3	1.0	7.0

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.469	0.68	0.23	0.14	
⊠	0.677	0.40	0.25	0.18	0.096



WASHINGTON STATE DEPARTMENT OF TRANSPORTATION - STATE MATERIALS LABORATORY
PO BOX 47365 OLYMPIA WA 98504-7365 / 1655 SOUTH 2ND AVE TUMWATER WA 98512

Physical Testing Section
Soils Test Report

Work Order No. **XL2406**
Lab ID No. **0000312047**
Lab Number **S -312047**
Trans. No. **479165**
Bid Item No.
Org. No. **346310**
F.A. No.

Date Sampled:
Sampled By:
Date Received: **05/23/2005**
S.R. No.: **405**
Section: **CANYON PARK FREEWAY STATION PEDESTRIAN BR**
Contractor:

==========

Material **SOIL**

Pit No.:

Quantity Represented:

Sample No: **4**

Sample Loc.: H-3-05 0-1.5'

GRADATION (AASHTO T-88):

SIZE	% PASSING	SPECIFICATIONS

ORGANIC MATTER (AASHTO T-267): %

PH VALUE (AASHTO T-289): 6.4

RESISTIVITY (AASHTO T-288): (OHMS) 15,000

HYDROMETER RESULTS (WSDOT TM 124):

SAND %		50 MAXIMUM
CLAY %		20 MAXIMUM
SILT %		---

SOIL TEXTURE CLASSIFICATION

==========

Distribution:
Materials File X
Region Construction
Project Engineer:
DAVE SOWERS X(2)

Result: **INFORMATIONAL**
Remarks:

THOMAS E. BAKER, P.E.
MATERIALS ENGINEER

Donald Brouillard By: Copy
Date: 06/08/2005
Phone: (360)709-5446

T42G-	T44J-	T44T-	
T43B- 1.0	T44K-	T44U-	
T43H-	T44N-	T44V- 1.0	
T44A-	T44P- 1.0	T2D1-	
T44G-		T2L0-	

soils.dfr 3/03

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION - STATE MATERIALS LABORATORY
PO BOX 47365 OLYMPIA WA 98504-7365 / 1655 SOUTH 2ND AVE TUMWATER WA 98512

Physical Testing Section
Soils Test Report

Work Order No. XL2406
Lab ID No. 0000312048
Lab Number S -312048
Trans. No. 479166
Bid Item No.
Org. No. 346310
F.A. No.

Date Sampled:
Sampled By:
Date Received: 05/23/2005
S.R. No.: 405
Section: CANYON PARK FREEWAY STATION PEDESTRIAN BR
Contractor:

==========

Material **SOIL**

Pit No.:

Quantity Represented:

Sample No: 5 Sample Loc.: H-3-05 4-5.5'

GRADATION (AASHTO T-88):

SIZE	% PASSING	SPECIFICATIONS

ORGANIC MATTER (AASHTO T-267): %

PH VALUE (AASHTO T-289): 6.3

RESISTIVITY (AASHTO T-288): (OHMS) 17,000

HYDROMETER RESULTS (WSDOT TM 124):

SAND %		50 MAXIMUM
CLAY %		20 MAXIMUM
SILT %		---

SOIL TEXTURE CLASSIFICATION

==========

Distribution:
Materials File X
Region Construction
Project Engineer:
DAVE SOWERS X(2)

Result: **INFORMATIONAL**
Remarks:

THOMAS E. BAKER, P.E.
MATERIALS ENGINEER

T42G-	T44J-	T44T-	
T43B- 1.0	T44K-	T44U-	
T43H-	T44N-	T44V- 1.0	
T44A-	T44P- 1.0	T2D1-	
T44G-		T2L0-	

Donald Brouillard By: Copy
Date: 06/08/2005
Phone: (360)709-5446

soils.dfr 3/03

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION - STATE MATERIALS LABORATORY
PO BOX 47365 OLYMPIA WA 98504-7365 / 1655 SOUTH 2ND AVE TUMWATER WA 98512

Physical Testing Section
Soils Test Report

Work Order No. **XL2406**
Lab ID No. **0000312049**
Lab Number **S -312049**
Trans. No. **479167**
Bid Item No.
Org. No. **346310**
F.A. No.

Date Sampled:
Sampled By:
Date Received: **05/23/2005**
S.R. No.: **405**
Section: **CANYON PARK FREEWAY STATION PEDESTRIAN BR**
Contractor:

==========

Material **SOIL**

Pit No.:

Quantity Represented:

Sample No: 6 Sample Loc.: H-4-05 3.5-5'

GRADATION (AASHTO T-88):

SIZE	% PASSING	SPECIFICATIONS

ORGANIC MATTER (AASHTO T-267): %

PH VALUE (AASHTO T-289): 6.9

RESISTIVITY (AASHTO T-288): (OHMS) 2,300

HYDROMETER RESULTS (WSDOT TM 124):

SAND %		50 MAXIMUM
CLAY %		20 MAXIMUM
SILT %		---

SOIL TEXTURE CLASSIFICATION

==========

Distribution:
Materials File X
Region Construction
Project Engineer:
DAVE SOWERS X(2)

Result: **INFORMATIONAL**
Remarks:

THOMAS E. BAKER, P.E.
MATERIALS ENGINEER

Donald Brouillard By: Copy
Date: 06/08/2005
Phone: (360)709-5446

T42G-	T44J-	T44T-	
T43B- 1.0	T44K-	T44U-	
T43H-	T44N-	T44V- 1.0	
T44A-	T44P- **1.0**	T2D1-	
T44G-		T2L0-	

soils.dfr 3/03

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION - STATE MATERIALS LABORATORY
PO BOX 47365 OLYMPIA WA 98504-7365 / 1655 SOUTH 2ND AVE TUMWATER WA 98512

Physical Testing Section
Soils Test Report

Work Order No. XL2406
Lab ID No. 0000312050
Lab Number S -312050
Trans. No. 479168
Bid Item No.
Org. No. 346310
F.A. No.

Date Sampled:
Sampled By:
Date Received: 05/23/2005
S.R. No.: 405
Section: CANYON PARK FREEWAY STATION PEDESTRIAN BR
Contractor:

Material SOIL

Pit No.:

Quantity Represented:

Sample No: 7 Sample Loc.: H-4-05 8.5-10'

GRADATION (AASHTO T-88):

SIZE	% PASSING	SPECIFICATIONS

ORGANIC MATTER (AASHTO T-267): %

PH VALUE (AASHTO T-289): 6.9

RESISTIVITY (AASHTO T-288): (OHMS) 25,000

HYDROMETER RESULTS (WSDOT TM 124):

SAND %		50 MAXIMUM
CLAY %		20 MAXIMUM
SILT %		---

SOIL TEXTURE CLASSIFICATION

Distribution:
Materials File X
Region Construction
Project Engineer:
DAVE SOWERS X(2)

Result: **INFORMATIONAL**
Remarks:

THOMAS E. BAKER, P.E.
MATERIALS ENGINEER

Donald Brouillard By: Copy
Date: 06/08/2005
Phone: (360)709-5446

T42G-	T44J-	T44T-	
T43B- 1.0	T44K-	T44U-	
T43H-	T44N-	T44V- 1.0	
T44A-	T44P- 1.0	T2D1-	
T44G-		T2L0-	

soils.dfr 3/03

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION - STATE MATERIALS LABORATORY
PO BOX 47365 OLYMPIA WA 98504-7365 / 1655 SOUTH 2ND AVE TUMWATER WA 98512

Physical Testing Section
Soils Test Report

Date Sampled:
Sampled By:
Date Received: 05/23/2005
S.R. No.: 405
Section: **CANYON PARK FREEWAY STATION PEDESTRIAN BR**
Contractor:

Work Order No. **XL2406**
Lab ID No. **0000312051**
Lab Number **S -312051**
Trans. No. **479169**
Bid Item No.
Org. No. **346310**
F.A. No.

==========

Material **SOIL**

Pit No.:

Quantity Represented:

Sample No: **8** Sample Loc.: H-8-05 0-5.5' (D-1 & D-2)

GRADATION (AASHTO T-88):

SIZE	% PASSING	SPECIFICATIONS

ORGANIC MATTER (AASHTO T-267): %

PH VALUE (AASHTO T-289): 5.6

RESISTIVITY (AASHTO T-288): (OHMS) 11,000

HYDROMETER RESULTS (WSDOT TM 124):

SAND %		50 MAXIMUM
CLAY %		20 MAXIMUM
SILT %		---

SOIL TEXTURE CLASSIFICATION

==========

Distribution:
Materials File X
Region Construction
Project Engineer:
DAVE SOWERS X(2)

Result: **INFORMATIONAL**
Remarks:

THOMAS E. BAKER, P.E.
MATERIALS ENGINEER

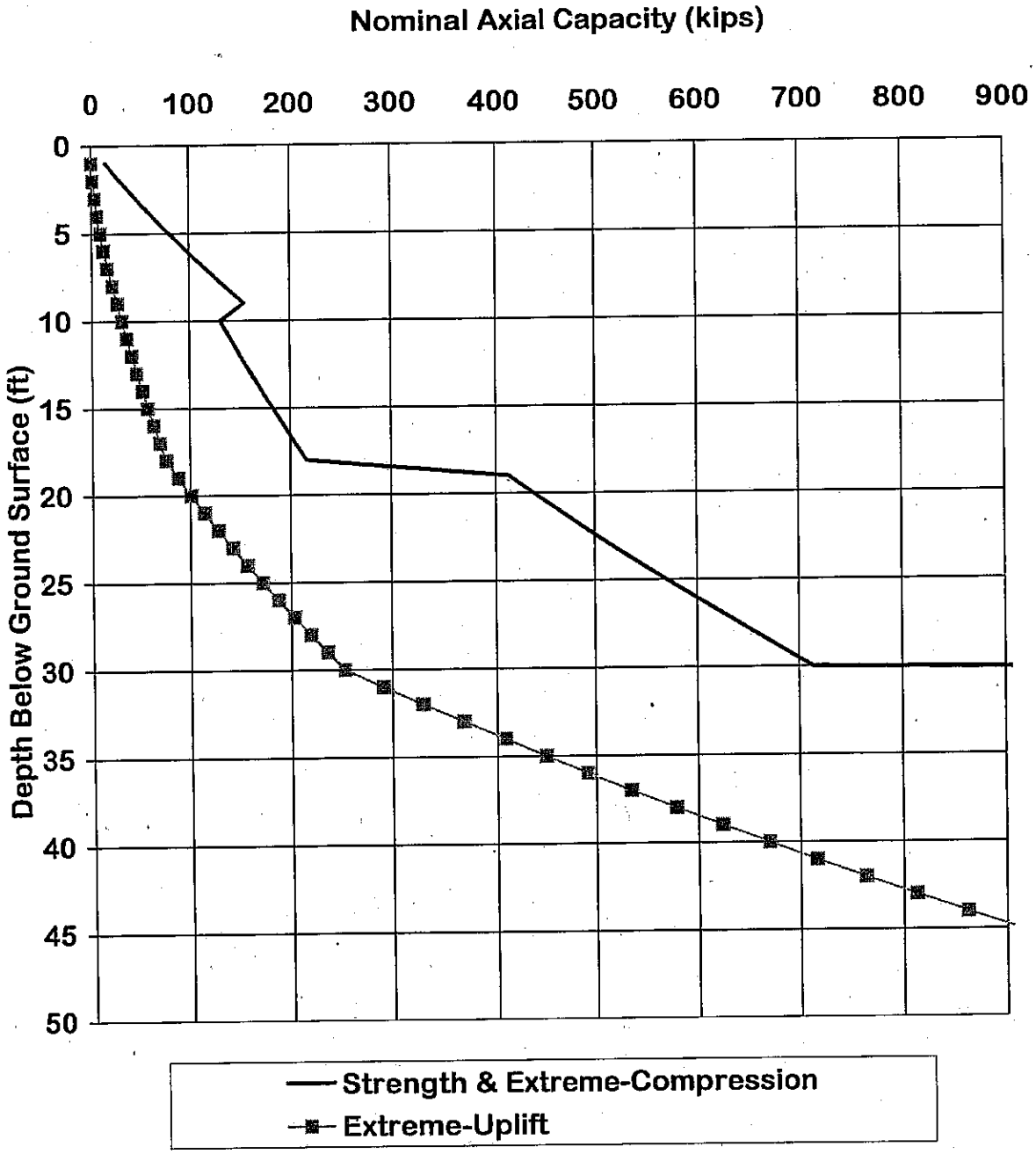
Donald Brouillard By: Copy
Date: 06/08/2005
Phone: (360)709-5446

T42G-	T44J-	T44T-	
T43B- 1.0	T44K-	T44U-	
T43H-	T44N-	T44V- 1.0	
T44A-	T44P- 1.0	T2D1-	
T44G-		T2L0-	

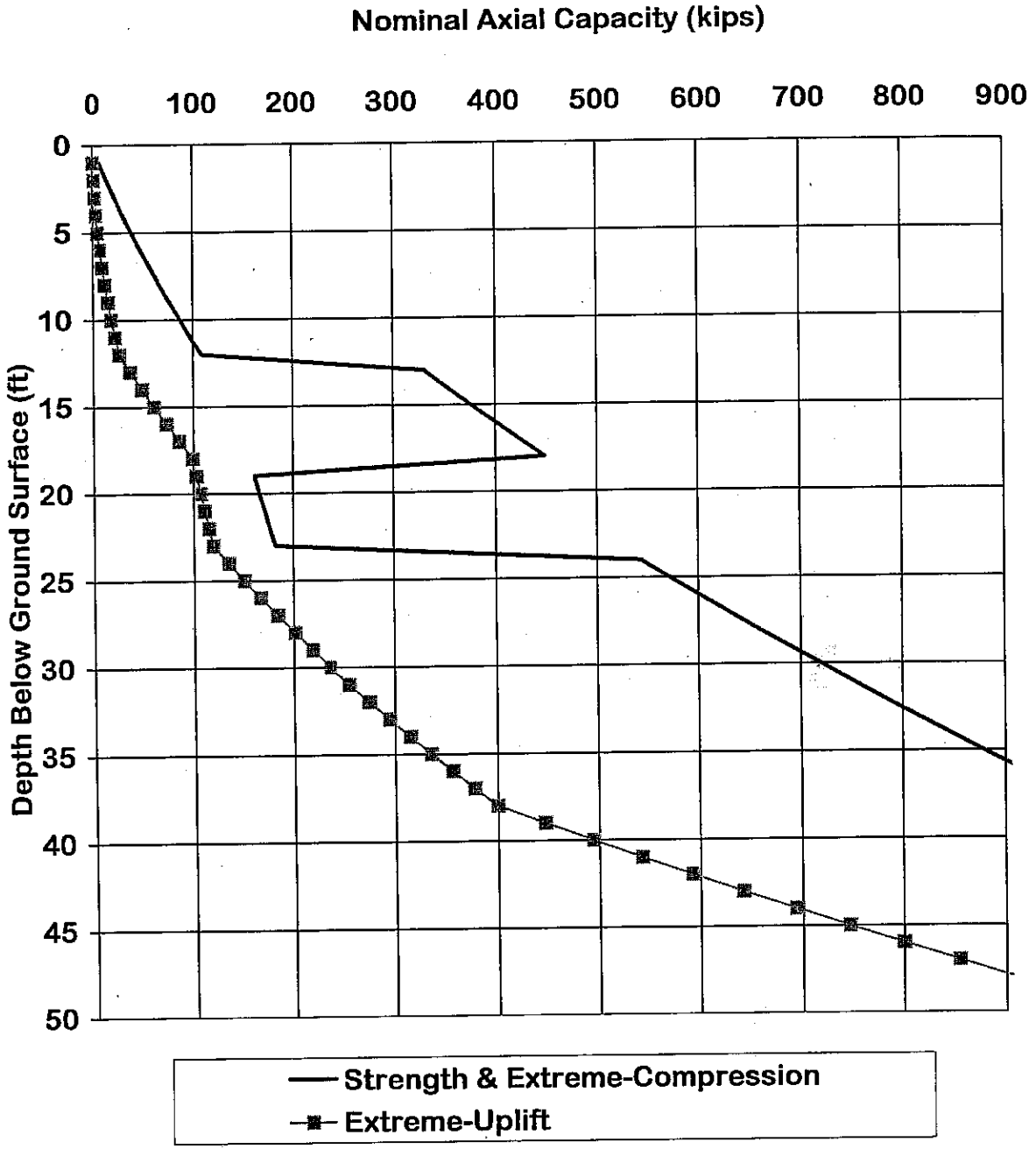
soils.dfr 3/03

APPENDIX D – FOUNDATION CAPACITY CHARTS AND P-Y INPUT PARAMETERS

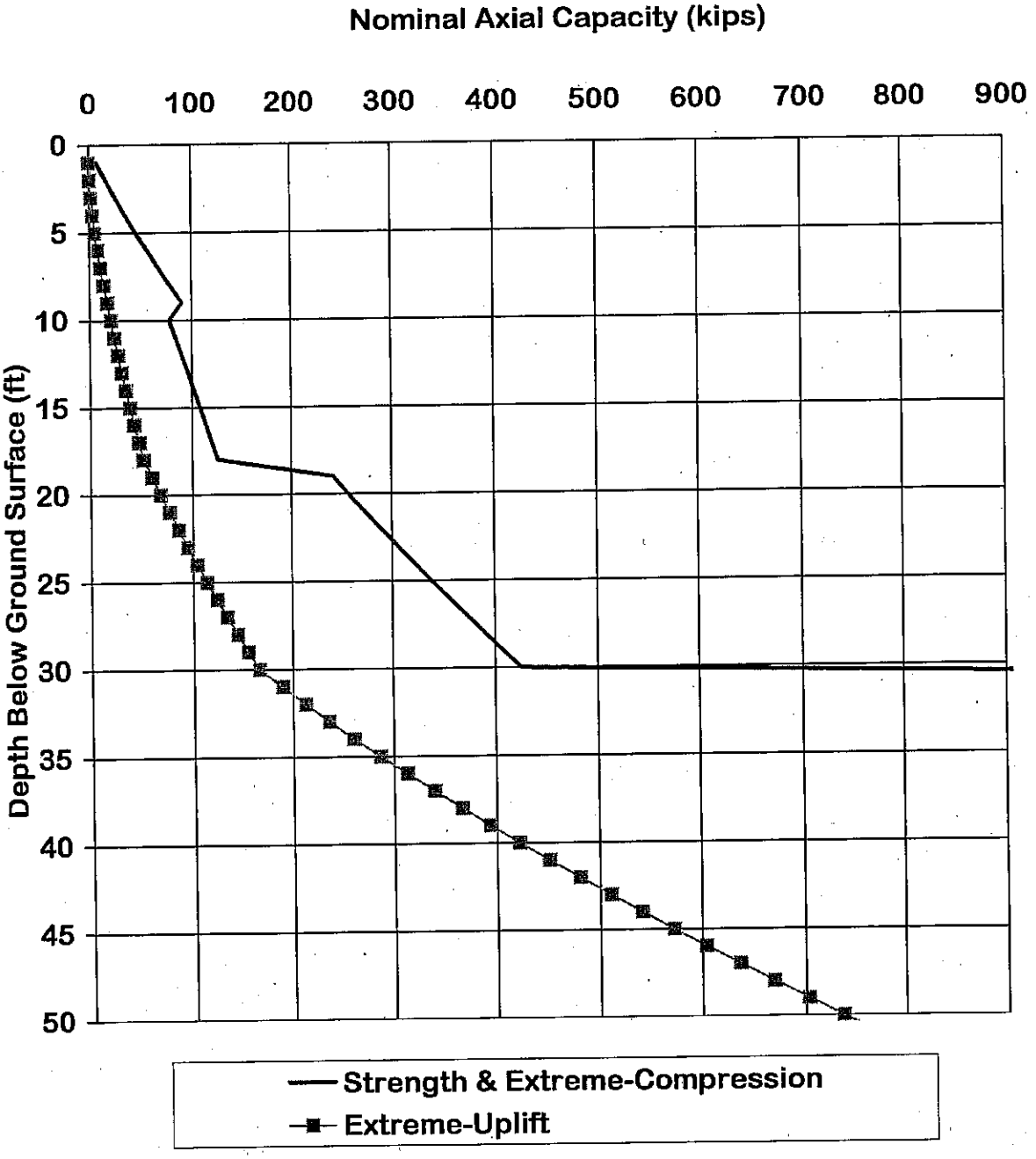
Canyon Park Freeway Station Pedestrian Bridge Piers 1,2,4 and 5
24-inch Closed End Steel Pipe Piles



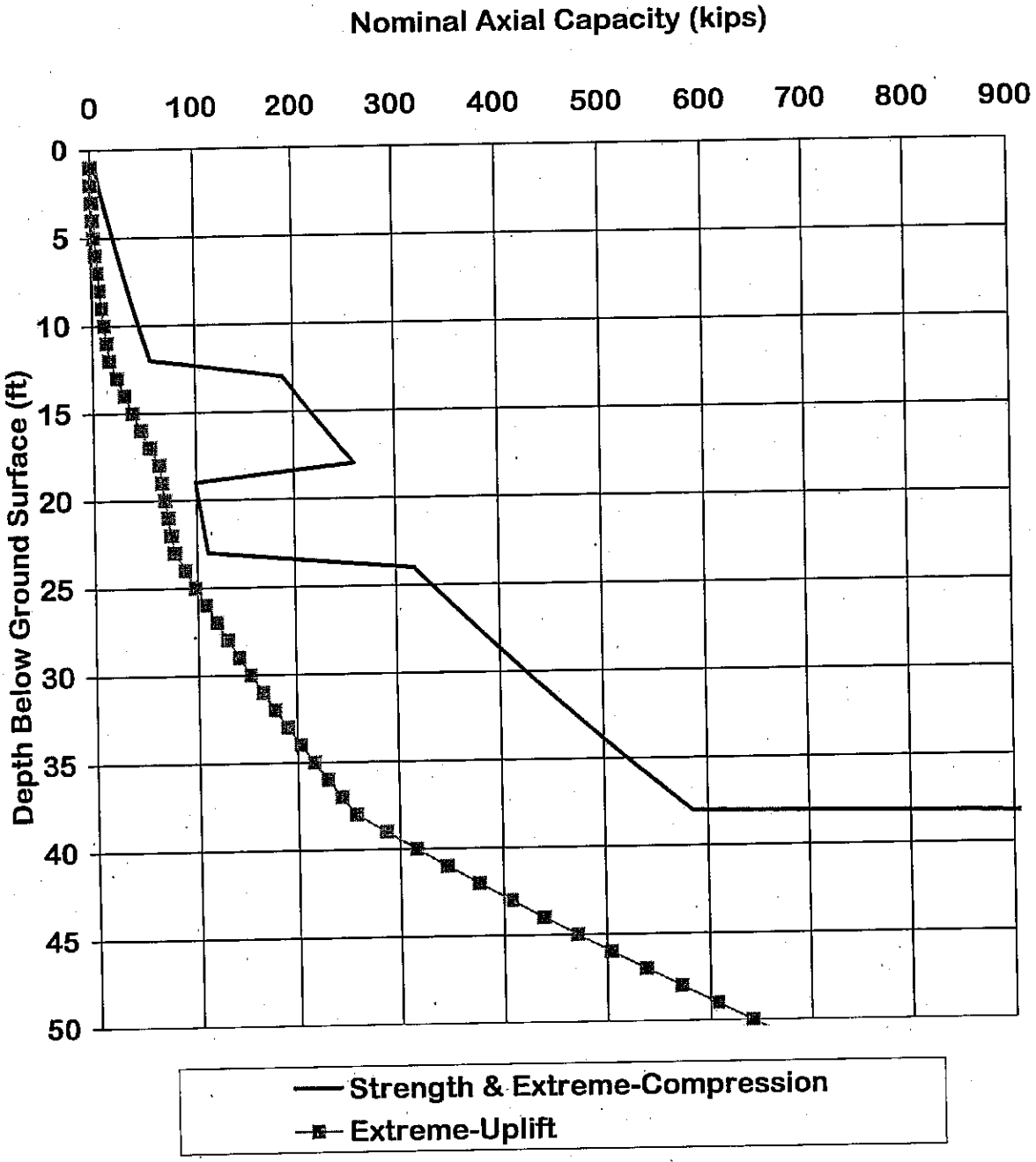
Canyon Park Freeway Station Pedestrian Bridge Piers 3 and 6
24-inch Closed End Steel Pipe Piles



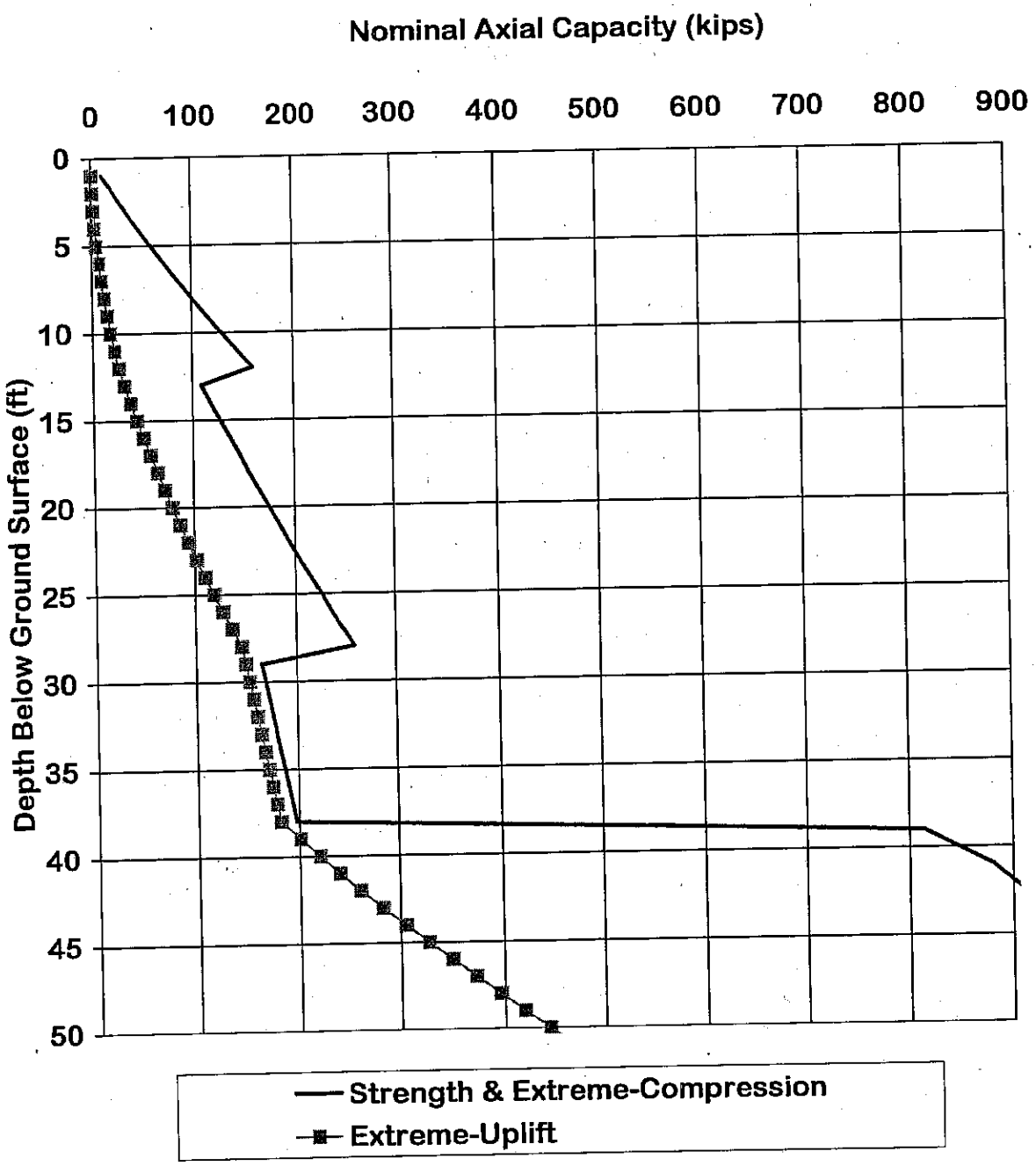
Canyon Park Freeway Station Pedestrian Bridge Piers 1, 2, 4 and 5
18-inch Closed End Steel Pipe Piles



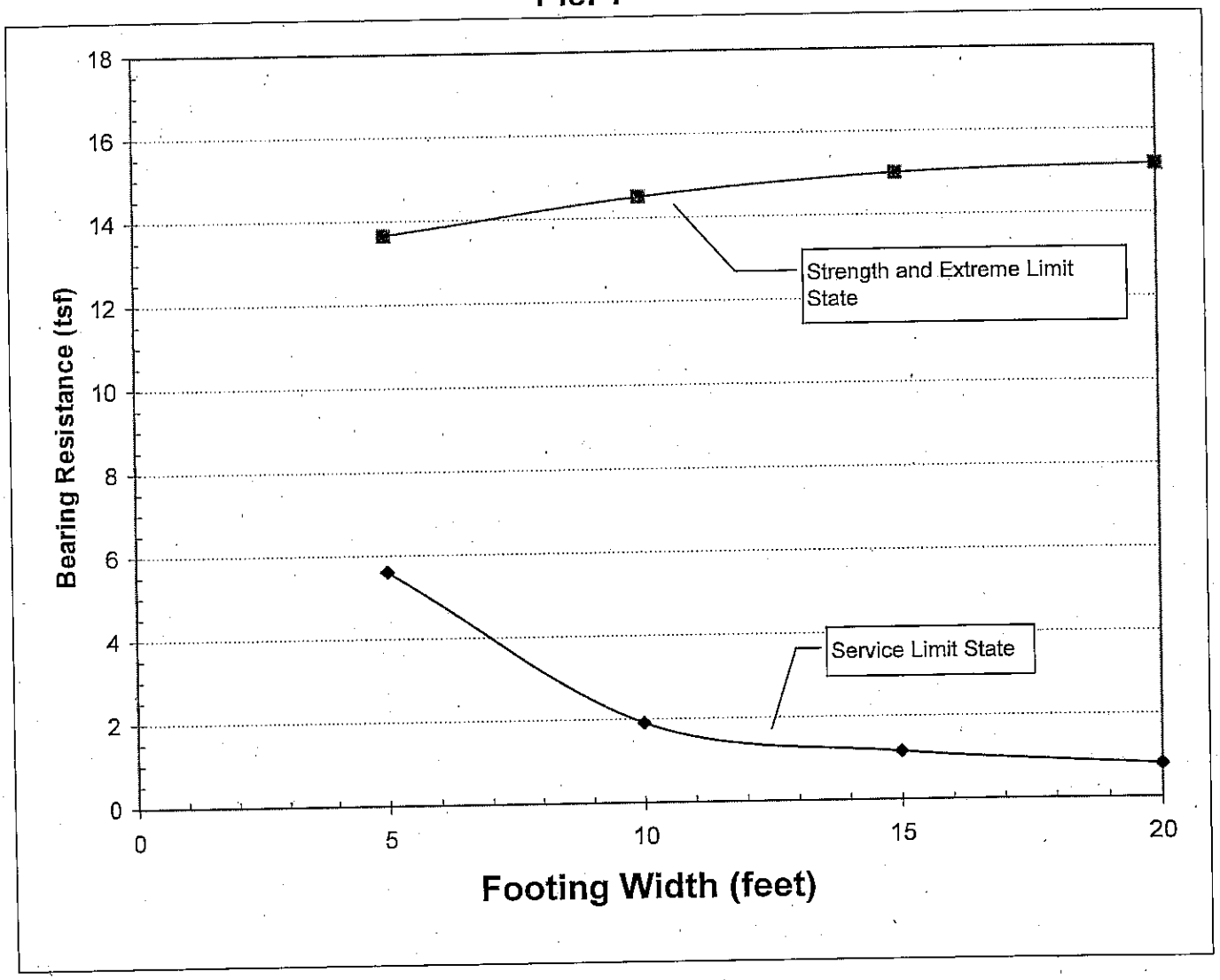
Canyon Park Freeway Station Pedestrian Bridge Piers 3 and 6
18-inch Closed End Steel Pipe Piles



Canyon Park Freeway Station Pedestrian Bridge Pier 7
18-inch Closed End Steel Pipe Piles

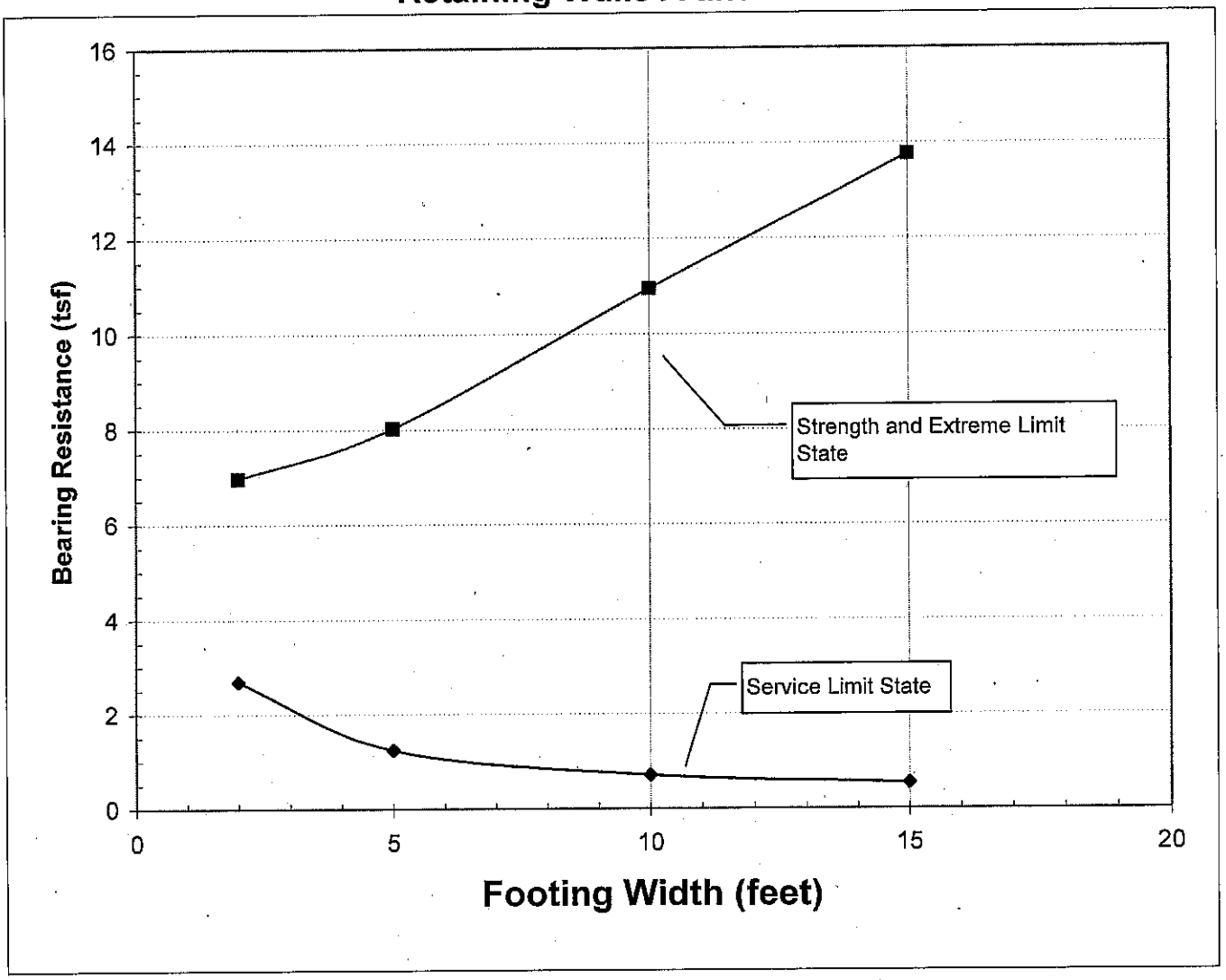


Nominal Bearing Resistance vs Footing Width
Pier 7



Note: Resistances for Service Limit State are limited by 1-inch of settlement

Nominal Bearing Resistance vs Footing Width
Retaining Walls A and B



Note: Resistances for Service Limit State are limited by 1-inch of settlement

Input Parameters for LPILE & S-Shaft
Canyon Park Freeway Station Pedestrian Bridge

General Site Information

Magnitude of Earthquake (500-yr event) : 7.5

Peak Bedrock Acceleration : 0.30

Peak Ground Acceleration : 0.30 (virtually no site amplification)

Pier 1

Existing Ground Surface Elevation = 125 ft

Based on Test Hole H-7-05

				STATIC/DYNAMIC ANALYSES								
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
1	0 to 9	SAND	4	18.9	0.069	120	0.0	0.0	0.0	-	34	110
2	9 to 18	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	32	50
3	18 to 30	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105
4	Below 30	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200

Pier 2 - STATIC CASE

Existing Ground Surface Elevation = 124 feet

Based on Test Hole H-6-05

				STATIC ANALYSES								
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
										0.010	-	350
1	0 to 8	CLAY	3	17.3	0.064	110	35.9	5.2	750.0	-	32	50
2	8 to 17	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	37	105
3	17 to 27	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200
4	Below 27	SAND	4	9.9	0.036	63	0.0	0.0	0.0			

Pier 2 - DYNAMIC CASE

Existing Ground Surface Elevation = 124 feet

Based on Test Hole H-6-05

				DYNAMIC ANALYSES										
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction	SPT N 60	Percent Fines
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci		
										0.010	-	300	-	-
1	0 to 8	CLAY	3	17.3	0.064	110	35.9	5.2	750.0	0.020	-	-	9	8.2
2	8 to 14	CLAY	1	9.1	0.034	58	23.9	3.5	500.0	-	37	105	-	-
3	14 to 27	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200	-	-
4	Below 27	SAND	4	9.9	0.036	63	0.0	0.0	0.0					

Pier 3 - STATIC CASE

Existing Ground Surface Elevation = 126 feet

Based on Test Hole H-5-05

				STATIC ANALYSES								
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
1	0 to 6	CLAY	3	17.3	0.064	110	95.8	13.9	2000.0	0.005	-	800
2	6 to 13	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	32	50
3	13 to 39	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105
4	Below 39	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200

Pier 3 - DYNAMIC CASE

Existing Ground Surface Elevation = 126 feet

Based on Test Hole H-5-05

				DYNAMIC ANALYSES										
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction	SPT N 60	Percent Fines
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci		
1	0 to 6	CLAY	3	17.3	0.064	110	95.8	13.9	2000.0	0.005	-	800	-	-
2	6 to 13	CLAY	1	9.1	0.034	58	23.9	3.5	500.0	0.020	-	-	9	8.2
3	13 to 39	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105	-	-
4	Below 39	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200	-	-

Piers 4 and 5

Existing Ground Surface Elevation = 127 feet (Pier 4)

Existing Ground Surface Elevation = 133 feet (Pier 5)

Based on Test Holes H-3-05 & H-4-05

				STATIC/DYNAMIC ANALYSES								
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
1	0 to 6	CLAY	3	17.3	0.064	110	47.9	6.9	1000.0	0.007	-	500
2	6 to 13	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	32	50
3	13 to 32	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105
4	Below 32	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200

Pier 6 - STATIC CASE

Existing Ground Surface Elevation = 138 feet

Based on Test Hole H-2-05

				STATIC ANALYSES								
Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
1	0 to 12	SAND	4	18.9	0.069	120	0.0	0.0	0.0	-	29	10
2	12 to 18	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	37	105
3	18 to 23	SAND	4	7.5	0.028	48	0.0	0.0	0.0	-	26	5
4	23 to 38	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105
5	Below 38	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200

Pier 6 - DYNAMIC CASE

Existing Ground Surface Elevation = 138 feet

Based on Test Hole H-2-05

Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	DYNAMIC ANALYSES										
				Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction	SPT N 60	Percent Fines
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci		
1	0 to 12	SAND	4	18.9	0.069	120	0.0	0.0	0.0	-	29	10	-	-
2	12 to 18	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	37	105	-	-
3	18 to 23	CLAY	1	7.5	0.028	48	7.2	1.0	150.0	0.020	-	-	3	18.8
4	23 to 38	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	37	105	-	-
5	Below 38	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	44	200	-	-

Pier 7

Existing Ground Surface Elevation = 141 feet

Based on Test Hole H-1-05

Soil Layer	Depth Below Surface	Soil Type	Soil Profile Type (KSOIL)	STATIC/DYNAMIC ANALYSES								
				Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus Subgrade Reaction
	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	pci
1	0 to 12	SAND	4	18.9	0.069	120	0.0	0.0	0.0	-	36	160
2	12 to 28	SAND	4	9.1	0.034	58	0.0	0.0	0.0	-	32	105
3	28 to 38	CLAY	2	7.5	0.028	48	47.9	6.9	1000.0	0.007	-	500
4	Below 38	SAND	4	9.9	0.036	63	0.0	0.0	0.0	-	40	140